ELECTRICAL CONSTRUCTION AND MAINTENANCE

With which is consolidated Electrical Contracting The Electragist and Electrical Record ... Established 1901

A practical technical and management journal for electrical contractors, industrial electricians, inspectors, engineers and motor shops, covering engineering installations, repairing, maintenance and management, in the field of electrical construction and maintenance.

November • 1948

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NOVEMBER . . . . at a Glance

Audible Signals

We don't usually try to light a large area by hanging a 1500 watt lamp in the center of the space. Yet, very often audible signals are installed just about as uncritically. Sound, like light, may come from many sources and can be concentrated or diffused. A proper installation of audible signals can be designed to fit the exact requirements of different kinds of areas and different noise levels. The methods are described by A. A. Schuhler in his article, "Selection of Audible Signals," beginning on page 60.

NECA Program

A quick preview of the convention schedule of the National Electrical Contractors Association in Miami Beach at the end of this month is given on page 53. The convention theme is "What About Tomorrow?" and the roster of subjects and speakers indicates a program of unusual interest and importance. A complete report of the sessions in story and pictures will be featured in the January 1949 issue.

Business Controls

A newcomer to our distinguished roster of authors is Ralph E. Johnson, vice president and general manager of Sturgeon Electric Company of Denver, Colorado. He explores a method of applying all overhead to labor on electrical construction work as a means of providing basic business control. The system enables quick checks of operating cost and, properly applied, will assure adequate coverage on all types of jobs. The article, "Check and Double Check," begins on page 54.

Pension Fund

One of the most complex labor-management projects in the electrical construction industry is the operation of the joint pension fund. The subject was in the fore front of discussion at the recent IBEW convention in Atlantic City. Joe Gambatese, well known labor editor and reporter, covered the convention for us and out of the discussions brought together a thoroughly objective report on the present problems and future prospects of this unique operation. His story appears in the news section beginning on page 197.

Cable Costs

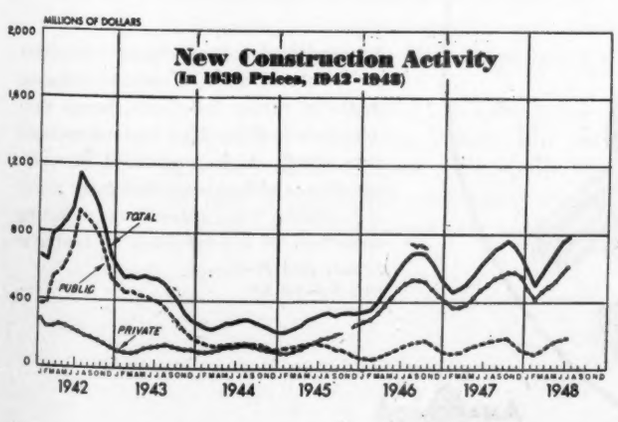
H. J. Finison continues his detailed study of cost factors in cable installations this month on page 58, showing how "installed cost" analyses indicate practical standardization of cable sizes to reduce stock cost and space.

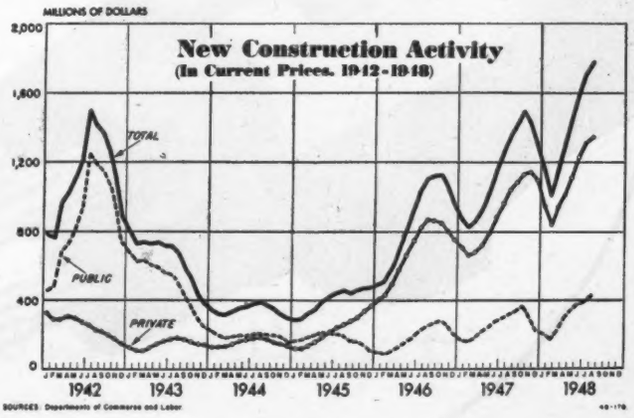
Louver Lighting

One of the most spectacular of modern lighting schemes is the louverall ceiling in which the entire ceiling becomes a light source with louvers diffusing and controlling the light from lamps installed above. J. R. Chambers and E. H. Church of Benjamin Electric Manufacturing Company in their article, "Louverall Lighting Systems," beginning on page 62, discuss new development in louverall ceilings and present results of efficiency tests on several types of installations.

Housekeeping

Taking care of miles of wiring, replacing thousands of lamps, and generally riding herd on an electrical system as large and elaborate as many small towns, is the work of the electrical maintenance organization in New York's Rockefeller Center. A 40-man electrical maintenance organization looks after 15 modern structures in mid-Manhattan and is set up to cope with an enormous variety of electrical problems. In the world's largest privately-owned business and entertainment center, electric service and safety must be maintained. How this operation is organized and how it takes care of some of the daily problems is told in Chief Engineer Rudolf Pollak's story of maintenance of "A City Within A City' on page 49.





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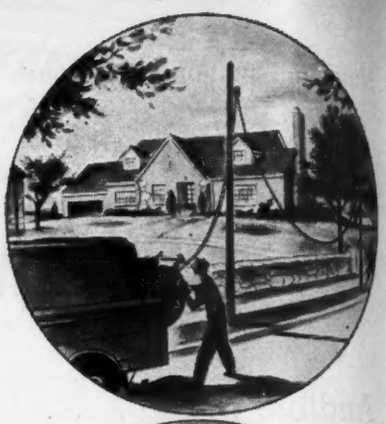

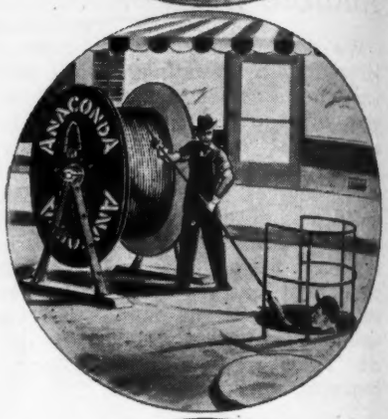

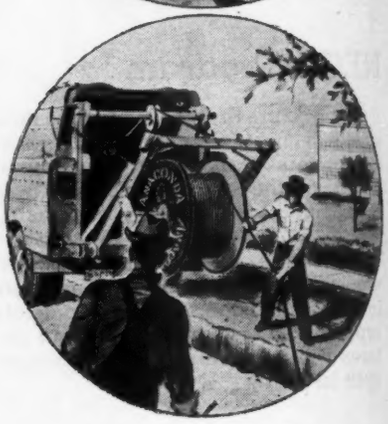

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ANACONDA

WHAT'S AHEAD

CONSTRUCTION REPORTS continue to point upward. A glance at the Commerce curves just preceding this page shows the pattern over several years. Dollar-wise we are apparently riding high. In terms of physical volume, however, present construction levels are hardly spectacular. In fact, new construction in 1948 will absorb only 8½ percent of the national income or about one-half the level of previous periods of prosperity.

THE NECA CONVENTION theme in Florida this month is "What About Tomorrow?". This month and next we'll all be working out budgets and setting our course for 1949 and beyond. Because present dollar totals loom large we are very likely to underestimate markets and opportunities. And this risk is particularly serious in electrical work.

IN TERMS OF NATIONAL INCOME, 10 to 15 percent encompasses normal new construction levels of past years. Compared with the current level, the spread is too significant to ignore. The figures, of course, simply emphasize what is obvious to everyone, that our economy is underbuilt and carrying a huge burden of obsolete structures.

LESS APPARENT, but just as predictable, is the pattern for electrical work. Electrical utilization is growing at a rate of 10 percent per year. There is no exact correlation but a 10 percent increase in physical wiring facilities per unit area per year would be a fair approximation of future needs.

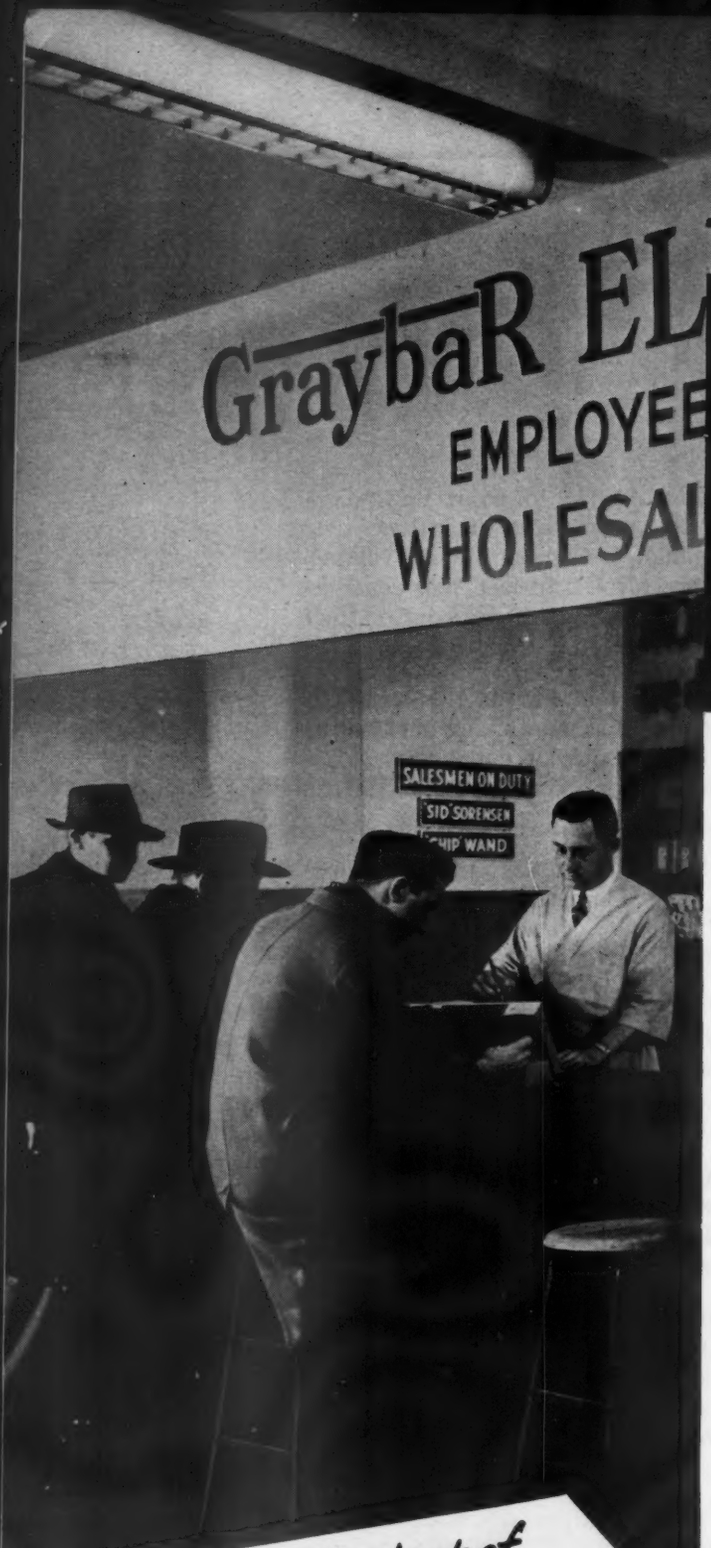
TO BRING CONSTRUCTION VOLUME up to the normal minimum next year would require a 17½ percent increase over present physical volume with a similar increase in electrical work. To absorb normal utilization growth in 1949 will take another 10 percent, or a potential gain of 27½ percent.

THAT GAIN must include pipe, wire, man-hours, panelboards, tape, inspection, engineering, supervision, capital, initiative, executive policy, and all the rest of the parts, components and services of this great complex industry. Before we credit this outlook as optimistic, consider the impact of such an increase in an already busy industry, on top supervisory personnel, for instance, or the prevailing shortage of skilled men.

A PERSISTENT SCARCITY of materials, notably steel, can delay the approach to normal building. That is beyond our control. If utilization growth is ignored, we betray a public trust. Individually we can ride along at current levels, but as an industry the future prospect must be faced and planned for.

MUCH CURRENT COMMENT implies that we are at the crest of a construction boom. The percentage of national income going into construction shows that we are actually far below normal. Together with the persistent increase in electrical utilization, we are compelled to accept the concept of an expanding electrical industry with greatly increased responsibility ahead.

Wm. F. Stuart



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SEE SPECIAL SECTION!

In this issue there's a big Graybar-supplier section of fact-packed advertisements on some of the items we distribute. Look for the buff pages.

ROCKEFELLER CENTER, consisting of 15 modern structures in mid-Manhattan, depends upon a 40-man electrical maintenance organization for continuity of power and light.

MAINTENANCE OF "A CITY WITHIN A CITY"

Electrical service and safety in the world's largest privately-owned business and entertainment center must be positively guaranteed; an objective achieved by effective maintenance.

By Rudolf Pollak

Chief Engineer
Rockefeller Center
New York City

OCCUPYING an area of more than 12.5 acres in the heart of Manhattan and physically consisting of 15 modern structures, Rockefeller Center is impressive. And, by every standard of measurement, it is outstanding. In cost of construction it represents an investment of $66.5 million. In rentable area it has a gross net of over 5.7-million square feet. In elevation the 70-story R. C. A. building towers 850 feet upwards while basement levels are 68 feet below ground. Over 32,000 employees work in the offices of more than 1100 tenants and daily visitors exceed 128,000, creating a resultant population of 160,000 which is surpassed by only 54 cities in the United States.

Altogether, Rockefeller Center houses the offices of 11 airlines, 14 railroad lines, 26 travel and information bureaus, dozens of national publications, 26 restaurants, 3 theatres, 35 radio and television broadcasting studios, 6 schools, a museum and exhibition hall. Also in the development are consulates of 20 countries as well as a U. S. Post Office, a government passport bureau, an 800-car garage and, in season, even an outdoor skating rink. Here are the headquarters of leading organizations in advertising, entertainment, finance, oil and manufacturing. Because of these diversified activities and the hundreds of facilities provided, Rockefeller Center is justly referred to as "a city within a city".

Translated into electrical terms

ADJUSTMENT OF ELEVATOR BRAKE is one of many maintenance operations designed for safety of passengers.

LIGHTING varies widely throughout the Center depending upon utility of space. The services of nine men are required for cleaning and relamping the ornamental installations, hung ceilings, coves, show cases, lobby fixtures and directional signs.

TRUCK-BASED EXTENSION LADDER can be moved, raised and extended to provide a platform for maintenance men.

these facts result in tremendous totals of kilowatts, wire mileage, motor horsepower and lumens of illumination. Monthly electrical consumptions average 7.2-million kw. Over 136 miles of copper wire are installed in the N. B. C. radio studios alone. Private telephone installations number over 28,000 (approximately the same total as are installed in the city of Utica, New York). And 8000 tons of refrigeration (equivalent to 5-million domestic refrigerators) are required for air conditioning. A total of 208 elevators, travelling at speeds ranging up to 1400 feet a minute, are required to provide 230,000 daily passenger rides and, in providing this service, these elevators run 750,000 miles a year and make over 60-million stops during each 12-month period. Vertical transportation also includes escalators, 15 in all, with a gross capacity of 100,000 passengers an hour.

When reviewing these facts and figures it becomes readily apparent that the breakdown or even a brief shutdown of equipment could result in major inconveniences to a vast number of people or could create conditions of positive danger. Therefore it is imperative that every possible precaution be taken to maintain continuity of electrical service. This was a paramount consideration in the initial design of service entrances, substations, distribution systems, control equipment and lighting installations. It is also the sole objective of the comprehensive maintenance organization which, in addition to the electrical and mechanical departments, includes sub-organizations for cleaning and policing.

In the electrical department, electricians are selected and trained for specific assignments, equipped with efficient tools and equipment to facilitate their work, and advanced to assignments of greater responsibility as rapidly as their initiative and abilities justify. Electrical maintenance at the Center requires the services of a chief electrician, foreman, over 40 men.

Of this total, five men specialize on the maintenance of motors, of which there are approximately 2000, not counting units of fractional horsepower. These men clean motors, perform Megger tests on motors and starters, change oil, maintain starter contacts, renew coils and perform other related operations.

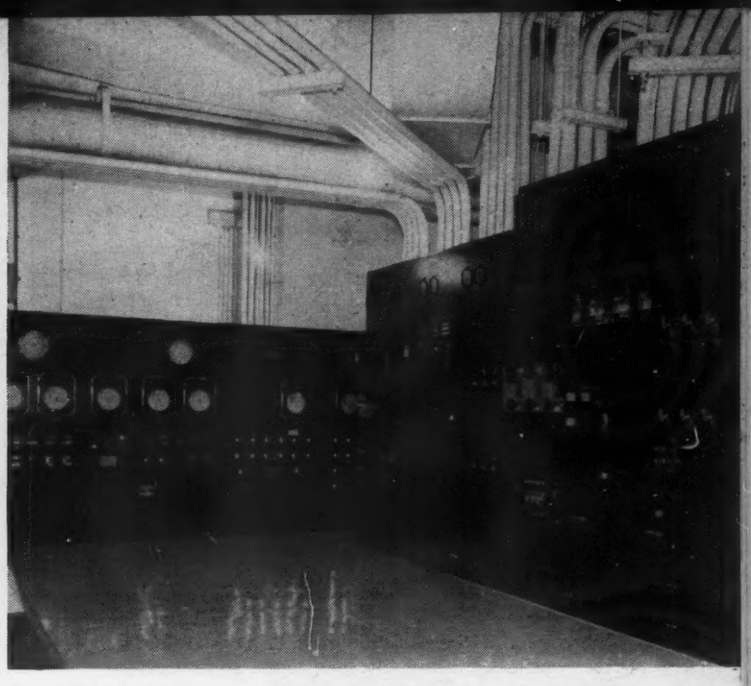
Nine men are assigned to public lighting; cleaning and relamping ornamental luminaires, hung ceilings, coves, corridor and public hall fixtures, showcases, and directional signs. They also replace defective receptacles and switches, and clean switchboard rooms, fixtures and housings.

Maintenance of lighting installations in tenant premises requires three men who supply fuses, lamps and switches to tenants, and control the operation of public lights located in areas not automatically regulated.

Two men maintain the 300-line PAX system and also service a specially-designed gate alarm system which notifies watchmen in each building whenever anyone descends a stairway from mezzanine to street levels.

Two men are assigned to low-voltage maintenance, including watchmen's telephones, signal systems, sprinkler alarms, Edwards' telephones, standpipe telephones and recorders. They also service the main control board where recording tapes, flashing lamps and buzzers indicate the position of watchmen and monitor fire alarms, sprinkler systems and other protective signals. These men likewise check high and low tank system and service all fan installations.

HIGH-RISE ELEVATOR MOTORS, largest and fastest of the Center's 208 elevator power drives, are checked regularly by electricians and mechanics trained for this specific assignment.



CONTROL PANEL FOR REFRIGERATION in R.C.A. Building regulates cooling unit weighing 32 tons. Maintenance requires two men.

Maintenance of the electrical portion of the Center's Dunham heating system also calls for the services of two men who, in addition, maintain the numerous roof-based antenna systems and the trucking-space carbon monoxide analysing units. In passing, it is of interest to note that this trucking space, located 34 feet below the level of the surrounding streets, keeps delivery trucks out of city traffic and makes it possible to load and unload in two subterranean shipping rooms with the aid of electrically-operated industrial trucks, overhead monorail cranes and other specialized equipment.

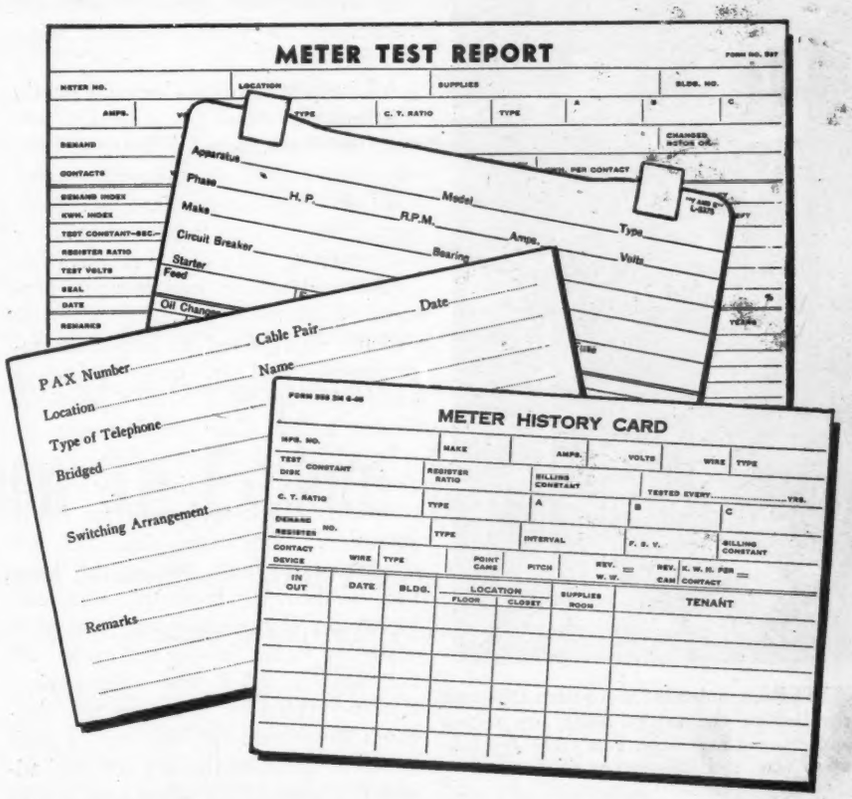
Electrical meters, of which there are approximately 2000, are tested and retaped by one electrician who follows a testing cycle of from one to three years, depending upon meter sizes. For operational and sub-metering purposes meters are read once a month and, so that all readings can be taken on the same day, twelve men are temporarily shifted from other assignments for this specific operation.

In the recently completed Esso Building (E. C. & M.—Feb. '48), the maintenance of more than ten miles of fluorescent lighting and numerous low-tension communication systems requires six electricians who are also responsible for small installations and alterations.

Five men and three helpers are assigned to tenant services such as buzzers, receptacles and telephone inserts. These men also maintain outside bracket lights, marquees, floodlights, step and walk lights and spotlights of all kinds. Parenthetically, it should be mentioned that outdoor lighting is designed not only for direction and safety but for decoration and ornamentation as well. Unusual thought has been devoted to landscaping and, although situated in a thriving business area, Rockefeller Center takes pride in terraced lawns, pools, flower gardens and tree-shaded promenades.

Rounding out the personnel of the electrical maintenance department, two men service all electrically-operated equipment used by the Center's Cleaning Division, such as vacuum cleaners, sanders, waxers and polishers.

With the scope and complexity of a maintenance service such as this, it is mandatory that organizational policies are established and rigidly adhered to. High installation standards are



RECORD CARDS and reports on motor data, meter testing, telephone and general electrical repairs are kept up to date and filed for purposes of billing, analysing recurrent faults and recommending operational changes.

CONTROL BOARD, in continuous operation since the completion of the first building in 1933, records locations of all watchmen and monitors fire alarm, sprinkler and other protective systems by means of tapes, lights and buzzers.

REPAIR ORDERS, relayed by the Service Bureau to the office of the Chief Electrician through pneumatic tube, are immediately checked, classified, and referred to a member of the emergency maintenance crew.

METERS, numbering more than 2000 and parallelling the utility units, are tested and retaped regularly. Test cycle depends upon size and importance of meters.

maintained, all assignments and compliances are confirmed for permanent record, and these records are maintained in a cross-indexed filing system.

All installation and alteration work, whether performed by the Center's electrical department or by independent contractors, is planned, supervised and approved by the Chief Engineer. This not only insures compliance with existing standards but furnishes complete data for maintenance purposes. N. E. Code provisions are consistently interpreted as minimum requirements and in many instances standards specified by Rockefeller Center exceed Code requirements.

In addition to following pre-scheduled maintenance routines, electricians constantly check equipment for faulty operation. Watchmen, also, look for conditions of fault, noting the location in their log books for route-end report or, if the condition is urgent, reporting to the Service test cycle over the nearest PAX line. Since electricians report by phone to the electrical department at the end of each group of assignments, any reported additional work in the same area can be authorized promptly and the cause of the emergency report can be rapidly checked.

The Service Bureau is a clearing house for all types of tenant complaints, service requests and emergency reports. Here seven girls answer incoming phone calls, typing all pertinent information on standard forms and immediately routing these typed reports through pneumatic tubes to the service departments indicated. These departments despatch men either directly from the department office or contact maintenance men by phone. Speeding service by phones, PAX and pneumatic tube frequently results in maintenance men arriving at trouble spots within a few minutes of initial reports. Forms, typed by Bureau Center operators, include the name of the tenant or reporter making the report, the location of the trouble, initials of the person receiving the call, date and time, service department to which the call is referred, and a brief notation of the nature of the trouble. Forms are numbered in duplicate so that reports can be filed both numerically and also alphabetically under tenant's name. After answering an emergency call and repairing the trouble, maintenance men briefly report the nature of the work performed and the results obtained. This information is also entered on the original forms so that complete reports are available for later reference.

In addition to the forms filled out for emergency work, there are also complete records kept of meter test reports, meter history cards, telephone repairs, motor characteristics and repairs, lamps supplied to various areas, perpetual inventories of material and numerous other data. These records are of vital importance in ordering material, checking recurrent faults,

[Continued on page 132]

PERPETUAL INVENTORIES are checked at least once a day to insure an adequate supply of the more than 3000 replacement items kept in stock. Rotating Wheeldex Card Systems, with colored tabs to designate the status of each item, are used to record all purchases, withdrawals and residual quantity of stock.

1948 ANNUAL NECA CONVENTION PROGRAM

Tuesday, November 30

Call to Order.....D. B. Clayton, *Vice Pres. NECA District Three*
Address of Welcome.....D. B. Clayton
Opening of Annual Meeting.....Robt. W. McChesney, *President*
Report of the Executive Vice President.....Paul M. Geary
Report of the Secretary.....Clint J. Harder
Report of the Treasurer.....Laurence W. Davis
President's Address—*What About Tomorrow?*....Robt. W. McChesney
Recommendations of Board of Governors....Clint J. Harder, *Secretary*
Open Forum—Report of Tellers

Wednesday, December 1

Opening of Session.....Robt. W. McChesney
Action on Proposed Amendments to the Constitution
Nomination and balloting for Vice Presidents from such new Districts as may be provided for in amended Constitution.
... Edmond R. Purves, Director of Public and Professional Relations, American Institute of Architects
Address.....Col. O. R. McGuire, *General Counsel of NECA*
Report of Tellers
Action on Resolution transferring assets, obligations and memberships to NECA, Inc.
Adjourn sine die the Annual Meeting of NECA Unincorporated
Call to order the Organization Meeting of NECA, Inc....Temporary Chairman to be elected by Incorporators
Action on Resolution Adopting NECA Constitution as amended as the by-laws of the Corporation, and electing all officers of NECA, Unincorporated, to be officers of NECA, Inc.

Thursday, December 2

Call to Order.....D. B. Clayton, *Presiding*
Technical Session.....A. C. McWilliams, *Chairman*
Objects and Purposes of the NECA Research Committee
A. C. McWilliams, *Chairman*
Chapter's Function in the Research Program.....J. Walter Collins, *Secretary NECA Research Committee*
Reducing Costs by Improving Installation Practices...Louis Kalischer, New York
The NECA Manual of Labor Units.....Howard Pancoast *High Point, North Carolina*
Cost Records .....Edward J. White, Newark, N. J.
Report of Code and Standards Committee.....George Andrae, *Chairman, Milwaukee*
Open Forum.....Ray Ashley, *Technical Director of NECA Research Committee*
Annual Banquet of NECA, *Roney Plaza Gardens*
The National NECA Apprenticeship Award for 1948.
The James H. McGraw Award of the Contractors Medal and Purse for 1948.

Friday, December 3

Call to Order.....Robt. W. McChesney, *President*
Address.....Dan W. Tracy, *International President of the International Brotherhood of Electrical Workers, Washington, D. C.*

Annual Meeting, IBEW Employers Section, NECA
E. C. Carlson, *Chairman*

Opening Statement, Roll Call and Approval of Minutes
Submission of Financial Statement.....A. Lincoln Bush
Report.....S. J. Cristiano, *Labor Relations Director, NECA*
Action on Proposed Amendments to By-Laws
Nomination from the Floor of Labor Relations Committeemen from such New Districts as may be provided for in amended by-laws.
Announcement regarding election procedure and appointment of tellers.
Report of Committee on Apprenticeship and Training..E. H. Herzberg, *Chairman*
Report on Employees Benefit Program.....Laurence W. Davis, *Executive Secretary and Treasurer*
Open Forum .....S. J. Cristiano
Report of Tellers
Report of Resolutions Committee

NECA Convention To Explore Industry Outlook

Miami Beach sessions November 30 to December 3 will discuss significant industry trends and prospects for the years ahead.

THIS year's program of the National Electrical Contractor's Association is built around the theme "What About Tomorrow?". Significant trends in the industry and programs of the Association designed to meet industry problems will be presented and analysed by participating experts from various parts of the country.

Preliminary sessions commence on November 23, the annual meeting opening formally on November 30 and continuing through December 3. The Roney Plaza Hotel at Miami Beach, Florida, is the convention headquarters.

One of the Convention highlights will be the Thursday morning session on December 2 at which time at a forum-type meeting the expanded NECA Research Program will be presented and discussed. Chairman A. C. McWilliams of Chicago of the NECA Research Committee will preside. Among those participating will be J. Walter Collins, secretary of the NECA Research Committee, Louis Kalischer of New York, Howard Pancoast of High Point, N. C., Edward J. White, of Newark, N. J., and Ray Ashley, Technical Director of the NECA Research Committee. George Andrae, chairman of the NECA Codes and Standards Committee, will report on his committee's activities and also those of the new Electrical Correlating Committee of the NFPA of which he is a member.

The Friday session will include the Annual Meeting of the IBEW Employers Section of NECA. That will feature reports by S. J. Cristiano, Labor Relations Director of NECA; E. H. Herzberg, chairman of the NECA Apprenticeship and Training Committee, and Laurence W. Davis, executive secretary and treasurer of the Employees Benefit Fund.

During the Annual Meeting action will be taken on incorporating NECA with all officers of NECA, Unincorporated, carrying over into NECA, Inc. Constitutional amendments to be acted upon provide for creation of a total of ten NECA Districts. Election of vice presidents for the newly-created District will be held as well as election of vice presidents in Districts Five, Six and Seven.

RALPH E. JOHNSON, vice-president and general manager, Sturgeon Electric Co., Inc.

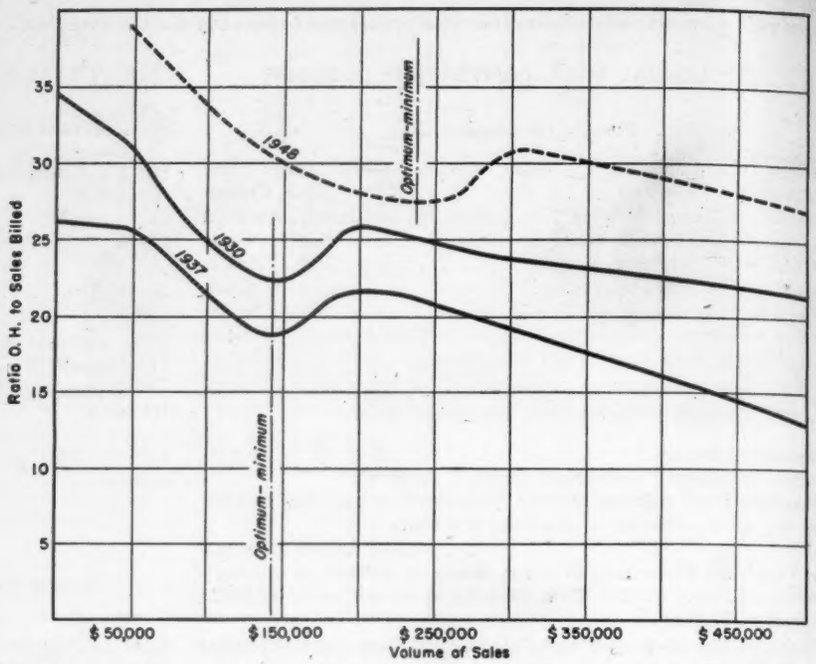


FIG. 1.—OVERHEAD TO SALES RATIO plotted against Annual Volume. Note where 1948 Optimum-Minimum point lies with respect to other curves. Basis, NECA Reports.

CHECK and DOUBLE CHECK

How application of all overhead to labor on electrical construction work provides basic business control, enables quick checks on operating costs, assures adequate coverage on all types of jobs.

By Ralph E. Johnson

Vice-president & General Manager
Sturgeon Electric Company, Inc., Denver, Colorado.

As our economy becomes more complex and our businesses become more competitive, it becomes increasingly important for our industry and its members to do everything possible to effect stability of operation.

One of the biggest disadvantages of small business is the inability of the small operator to maintain an adequate check on his business so that he would be in a position to act when danger signals begin to appear. Recent statistics published by the National Electrical Benefit Fund show that nearly 90 percent of reporting contractors could be classified as small business operators. It is imperative for the stability of the industry that procedures be developed whereby businesses of all types and sizes can function with success and be able to constantly check the economic position of their operations. Operators in our industry function under such widely differing conditions that such procedures must be applicable to all conditions encountered.

Basic to all checking systems is, of course, a sound accounting system developed with the intent of arriving at a specific answer by which the principal factors can be judged. Most businesses of any consequence today have some semblance of a bookkeeping setup, but it would be safe to assume that probably very few have been developed to the end of effecting any business control. Satisfactory controls can be established which are simple to administer. Complex controls are impractical.

Our business operations are no different from nearly all other types in that there are two variables which business men are constantly fighting to govern, namely Overhead and Volume. The problem practically would be solved if it were possible to develop a basic control which incorporates both of these factors. It is possible to do just that.

Volume of Sales in the electrical installation business is a direct function of man-hours worked. It makes no difference if those man-hours are journeymen or apprentice. It would be impossible to build up a volume of sales without man-hours of labor.

In the electrical construction indus-

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BID SUMMARY SHEET

JOB A & D INVESTMENT CO Date 8-26-48

RECAPITULATION:

	Material	Labor—Hours
Code R Roughing-in — Cost	$ 54x.54	4x1
Code W Wire and Accessories	334.14	85
Code D Devices	53.84	35
Code E Equipment	340.93	101
Code F Fixtures	2981.32	191
Code S Special		
Total	$ 4,55x.37	883
Net Material Cost		$ 4,55x.37

Foreman Labor	Hours @ $		$
Journeyman Labor	883 Hours @	2.25	198x.00
Apprentice Labor	Hours @		
Productive Labor Cost	883		198x.00

Job Factors (add):

Type of Building	%		
Working Conditions	%		
General Contractor	%		
Non-productive Labor	%		
Total	%	Hours @ $	$
Total Labor Cost	883	Hours	198x.00
Labor Burden	883	Hours @ $ 093	8x0.00
Total Labor Cost Plus Burden			$ 71ex.00

JOB EXPENSE:

6 % of 198x.22 Labor Cost — Employment Tax		$ 118.50
Permits: 4 Large Motors	@	$ 6.00
18 Small Motors	@	9.00
2x0 Outlets	@	23.00
33⅓ Fixtures	@	16.90
Miscellaneous	@	
Total Permit		$ 54.90
Special Engineering		
Cartage, Freight, and Express		
Field Offices, Shop, and Expense		
Travel Expense, Board and Lodging		
Sub-contracts		
Commission % of		
Miscellaneous		
Total Job Expense		$ 176.90
TOTAL GROSS COST		7,581.27
11 % RETURN		830.00
5 % Sales Tax on $ 4,55x.37 Material Cost		137.00
10.4 % Excise Tax on $ 3a3.35 Material List		31.60
NET BILLING		8,529.87
Performance Bond 1 %		85.30
Price to Customer — $ 8,615.22	Grand Total	8,615.17

PREPARED BY CHECKED BY

FIG. 2.—BID SUMMARY SHEET now used. Note how Overhead is added as an hourly labor-burden (circled) with Return added to Total Gross Cost.

BID SUMMARY SHEET

JOB A. & D. INVESTMENT Co. Date 8-26-48

Total Wiring Material Cost	$ 1230.22	
Total Heavy Equipment Cost	$ 340.93	
Total Lighting Fixtures Cost	$ 2981.22	
Grand Total Material Cost	$ 4,552.37	
Less — % Cash Discount	$	
Net Material Cost	$ 4,552.37	
Plus 9 % O. H. Margin	$ 410.00	
Material Plus Overhead		$ 4,962.37
Total Labor: 883 Hours @ $ 2.25	$ 1,982.00	
Plus 31 % O. H. Margin	$ 612.00	
Labor Plus Overhead		$ 2,594.00

JOB EXPENSE:

6 % Employment Tax on Labor	$ 118.50	
1 % Association Fees L.O.E.	$ 19.82	
Permit—Large Motors @ $1.50	$ 6.00	
Permit Small Motors @ 50	9.00	
Permit Outlets 2x0	23.00	
Permit Fixtures 33⅓	16.90	
Total Permit	$ 54.90	
Special Engineering	$	
Travel Expense	$	
Job Set-up Time	$	
Miscellaneous	$	
Total Job Expense		$ 196.72
Total Gross Cost		$ 7,753.09
Plus 11 % Return		$ 852.00
Total Net Billing		$ 8,605.09
Sales Tax on Material Cost + EXCISE TAX		$ 168.60
Performance Bond 1 %		$ 87.73
Total Price to Customer $8861.42		$ 8861.42

Prepared by Checked by

FIG. 3.—OLD STYLE BID SUMMARY sheet used when split-overhead system was used—applied to both labor and material costs. Compare with new method.

try there seems to be a dearth of statistical information upon which facts can be developed and intelligent decisions made as to the proper procedure to follow in correlating the actual operation of the business with the estimate. One of the most perplexing problems facing all electrical contractors is—and has been—that of covering the total cost of overhead in their estimates. It is an undisputed fact that a man could be a perfect estimator and still his business would operate at a loss. If the operation is to be successful, the finalizing of an estimate *with the proper addition of percentages for Overhead and Profit* is almost as important as the preparation of estimates, other things equal.

Many systems have been developed to determine the amount of money that must be added to job estimates to cover the cost of doing business. Some of these systems have been remarkably close to accuracy. However, one great disadvantage of all has been that they were all too general in nature. Not one has been developed that takes care of the individual requirements of the individual business.

Much has been said recently about "Labor-Only" jobs. The facts still remain that, by the very nature of our work and in consideration of our relationship with other branches of the entire electrical industry, we are going to be subjected to bidding on such jobs. If an operating or pricing procedure is to be completely applicable to all conditions, it must function under "Labor-Only" setups.

By the same token, to be successful such a procedure must enable the members of our industry to compete with all competitors for the sale of power and lighting equipment. We are rapidly losing all semblance of grasp in this field, and if we are ever going to stabilize man-hours of employment we must be in a position to go out in the open market and create such man-hours of work and keep our worthwhile forces steadily employed. Thus we preserve our only sales tool.

As long as the proper relationships are established and preserved between organized labor and organized employers, we will probably be able to preserve our fields of endeavor against outside intrusion and thus avoid the loss of the important trade commodities we have in the case of manpower and lighting equipment.

Single OH Item on Labor

With all of these factors in mind, the subject of percentage adders was pursued with increasing assurance that the most positive way of establishing Overhead Burden was to apply it directly to Labor Hours—in terms of dollars and cents instead of percentage; also to establish the dollars and cents as a direct function of actual overhead cost in terms of actual man-hours worked by the particular business in question.

Whether the individual recognizes this overhead adder as a function of labor cost per hour worked, or whether it is merely added as a percentage of the total is important only insofar as the manner in which it ties into the rest of the accounting procedure used in the business. This is where the control feature comes in.

Total Overhead can be very easily expressed in terms of *overhead cost per man-hour worked.* Immediately

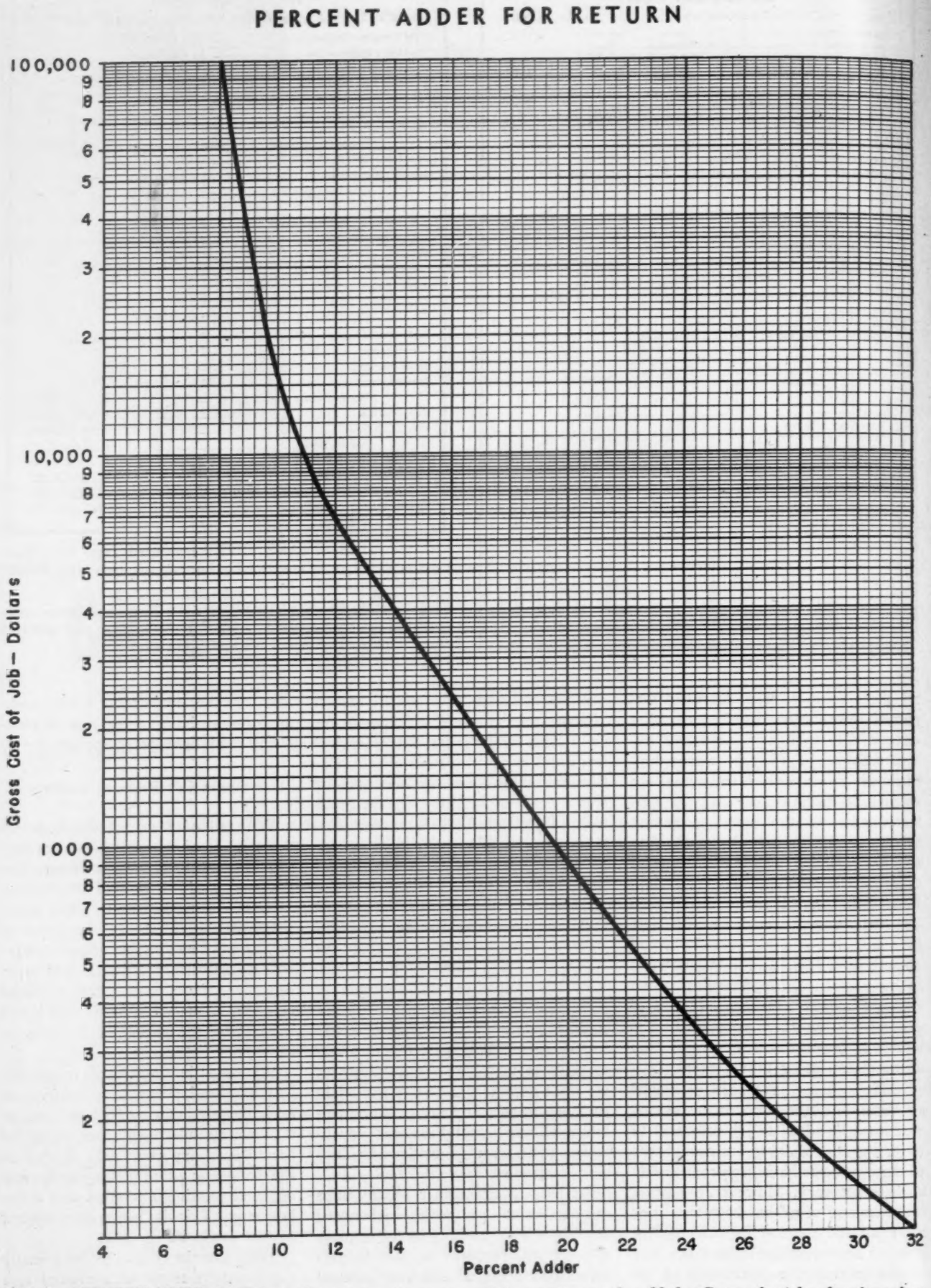


FIG. 4.—PERCENT ADDER for Return. Curve presents recommended percentages to be added as Return for jobs of various sizes.

we tie together the two great variable factors of our business. At the same time, we develop an "adder" for all of our estimates that definitely assures dollar coverage of overhead costs in our estimates.

Yes, this procedure means that we are *adding all of our Overhead to labor, and none of it to material costs.* In so doing we are further assuring complete and adequate coverage of all overhead costs regardless of whether or not the job involves any material. *Therefore, labor-only jobs are completely covered.* By the same token, we are protecting the furnishing of fixtures and equipment by adding very small mark-ups to all material costs.

But, the biggest factor of all in following this procedure is that all of the cost of doing business is completely covered as it actually exists in our estimates—in accordance with actual accounting costs for the particular business in question.

Up to the present time, most of the statistics which have been developed have been for a particular area of the country, and hence businesses in other parts were subject to these factors whether they existed locally or not.

Since this matter of running a business successfully merely resolves itself into mixing up a lot of dollars of different denominations, and coming out at the end of the year with a profit, it appears only logical that each item that enters into the transaction must be well understood and apply directly to the immediate detail, and not find its origin in what's happening in some other spot under quite different conditions.

If we divide the total cost of our overhead by the total number of man-hours worked, and find that the overhead cost per hour is unreasonably high, then it is necessary that immediate action be taken to either reduce the overhead or increase the number of man-hours worked by bidding more jobs.

Inasmuch as there are no statistics available to show approximately or accurately what the cost per hour should be, an analysis of the NECA Report of 1937 was made on the basis of the ratio of Overhead Cost to Labor Cost and the ratio of Overhead Cost to Sales. There was absolutely no correlation between these factors and profit. This shows that profit can be made by a business with an exorbitant overhead if proper margins of operation are provided for—and conversely.

Also, tying directly into this is the plotting of overhead costs for various types and volumes of businesses to determine the optimum volume at which to operate. Fig. 1 shows the results of plotting NECA Reports for 1930 and 1937 and then projecting these figures to today's conditions.

This curve should have profound significance for anyone planning to start an electrical contracting business. It shows conclusively that it would be very difficult to compete unless the volume of business today is at least $230,000 per year, and if it is under this figure, extra overhead must be added to come out with profit.

One form of Bid Summary Sheet is shown in Fig. 2 in which the basic principles of procedure set forth in this discussion have been utilized. You will note that *all Overhead has been added to Labor as an hourly Labor-Burden.*

Split Versus Single-Overhead System

The old tried but untrue method of summarizing a job has always been to add a percentage for Overhead to the total cost of material, plus labor, plus job expense; and then to add a percentage to the gross cost for profit or return. This method might have been alright if accurate curves for percentage adders had been developed for each particular business, and if all jobs had consistently the same percentage of labor and material. Since neither of these factors were ever developed to my knowledge, this method is erroneous.

The Electrical Contractors Association of City of Chicago made a great step in the right direction when they developed a curve for adding separate percentages to both labor and material to compensate for the jobs where both factors are out of balance with the usual 60/40 ratio. However, the curve was developed for a business doing an annual volume of $500,000 and no provisions were made for businesses whose volume differed from that. Even though several businesses were in that volume category, their operating setup could vary so widely as to cause the curve to vary greatly.

Fig. 3 shows a Bid Summary Sheet for the same job as Fig. 2. In Fig. 3, however, the percentage adders are set up on the basis recommended by the curve developed by the Electrical Contractors Association of City of Chicago with the same percentage (as in Fig. 2) added for Return. The two procedures are highly comparable and the

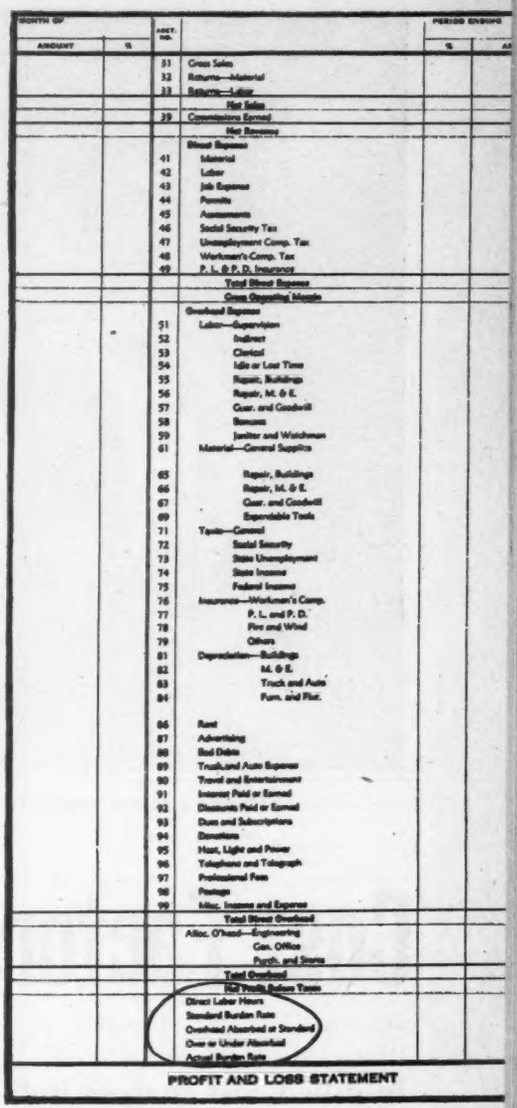


FIG. 5.—TYPICAL P & L statement showing how Labor-Burden Rate is carried on the books (circled) and is ever-present as an indication of operating trends.

same basic philosophy is established in both, except that the form set forth in Fig. 2 is applicable to any business of any size and is developed for application to the exact conditions which prevail in a particular business.

In analyzing the job set forth in these two Bid Summaries, you will note that the Labor is only 30 percent of the total prime cost. In the normal job, the Labor is 40 percent of the prime cost. If the old method of adding one percentage to the total prime cost has been employed, there would have been an insufficient allowance made for actual Overhead Cost. There would have been a greater difference in the two procedures if the percent material of the job in question had been higher, because in one case we are adding two

[Continued on page 144]

FIG. 14—Selection of a few cable sizes as standards can achieve savings in cable stock cost and space.

Cost Factors for Cables . . . . Part III

Installed cost analysis indicates practical standardization of cable sizes.

By H. J. Finison

THE information which has been presented in previous articles in this series on cable costs can be helpful in picking a few sizes of cable that can be adopted as standard for industrial plant distribution services.

Advantages of Standardization

In any industrial plant there will be considerable advantage in standardizing on a few sizes of cable and using them for all installations, even though for some applications they may not be nearly loaded to their actual rated capacity. Some of these advantages are:

(1) It will be possible to order cable promptly without waiting for a detailed layout of the installation.

(2) It will be possible to order larger quantities of any one size cable as well as conduit and fittings where these are used and thereby obtain savings from larger quantity purchases.

(3) Less opportunity for error in installing wrong size cable.

(4) Less of a problem in stocking spare cable (See Fig. 14)
   a. Lower inventory.
   b. Less space requirements for storing.

In addition, unless the actual load supplied is a unit load such as an individual motor for which the current is accurately known, any evaluation of size, especially for a cable feeding a number of loads, is purely an estimate and cannot be determined precisely. Hence, any attempt to match the estimated load with a cable size is at best an approximation.

The advantages listed have caused many industrial plants to adopt standard sizes and they are already enjoying the benefits of standardization. Unfortunately, there is no uniformity among the thousands of industrial plants and each plant has a different selection of standard sizes. Hence, this standardization does not achieve maximum savings that would be possible by

TABLE 7

Possible Type RH cable sizes for supplying a 125-ampere load

Cable Size Awg	Rated Amps	Dollars per ampere per 100 Feet	Percent more than cost of Minimum permissible size for 125 amps
0	132	$2.00	
00	154	2.06	3%
000	176	2.12	6%
0000	202	2.70	35%

TABLE 9

SUMMARY OF CABLE ESTIMATING DATA

Data given in bold face type are for suggested standard sizes

Installed cost and installed cost plus capitalized losses are dollars per 100 ft. Losses computed at cable rating and capitalized at $80 per kw

Three single conductor 600 volt cables in steel conduit (except ACV) installed in typical factory building

Current rating at 40 C ambient

AWG or MCM	Type R Code Rubber			Type RH Versatol-Geoprene			Type T Flamenol			Type V Varnished Cambric Braided			Type VL Varnished Cambric Leaded			Type ACV Interlocked Armor		
	Rated Amperes	Installed Cost	+ Cost Losses	Rated Amperes	Installed Cost	+ Cost Losses	Rated Amperes	Installed Cost	+ Cost Losses	Rated Amperes	Installed Cost	+ Cost Losses	Rated Amperes	Installed Cost	+ Cost Losses	Rated Amperes	Installed Cost	+ Cost Losses
8	33	$64	$81	40	$75	$100	33	$71	$88	45	$70	$102	45	$122	$153			
6	45	81	101	57	96	128	45	90	110	63	91	130	63	151	190			
4	57	104	124	75	124	159	57	117	138	81	116	157	81	164	205	91	$102	$154
2	78	118	142	101	144	184	78	137	161	108	131	177	**108**	**182**	**228**	121	124	181
1	**90**	**145**	**170**	**114**	**171**	**212**	**90**	**172**	**198**	**126**	**160**	**209**	126	236	285	**139**	**140**	**200**
0	103	183	210	132	211	255	103	215	241	140	196	245	140	250	299	161	168	233
00	119	198	225	154	227	274	119	230	259	166	213	268	**166**	**270**	**325**	185	187	255
000	**135**	**216**	**245**	**176**	**240**	**290**	**135**	**255**	**284**	**189**	**237**	**294**	189	338	395	**213**	**213**	**286**
0000	160	281	314	202	311	364	160	326	359	212	304	362	**212**	**364**	**422**	244	262	339
250	**176**	**304**	**338**	**224**	**340**	**395**	**176**	**360**	**394**	**243**	**333**	**398**	243	468	533	**270**	**296**	**376**
350	**213**	**400**	**436**	**273**	**446**	**505**	**213**	**472**	**508**	**292**	**436**	**504**	**292**	**531**	**599**	**334**	**378**	**466**
500	**262**	**472**	**513**	**334**	**528**	**595**	**262**	**572**	**613**	**364**	**522**	**601**	**364**	**694**	**773**	**417**	**469**	**574**
750	328	669	713	418	748	819	328	812	856	450	844	926	450	948	1031	529	638	752
1000	373	854	901	480	951	1028	373	1050	1097	526	944	1037	526					

Note: These figures should be used for preliminary estimating for cost comparisons. They are not expected to be sufficiently accurate for final estimating purposes.

industry wide standardization. If all plants adopted the same standard, real savings could be reflected in manufacturing cost of cable and thereby in the selling price to the industrial plants. These manufacturing cost savings result from longer production runs of a single cable size and use of more highly specialized production machines and methods. In addition, there would be reduction in costs for warehouse and supply phases of making cable available to the industrial plant.

Causes of Non-Uniform Cost

It will be noted that in reference to the charts of Figs. 5 to 10 the difference between the installed cost of cable does not vary uniformly with a change in cable rating due to the following reasons:

(1) Conduit size changes at intervals so that a particular size conduit may be used for two or three successive cable sizes.

(2) Insulation thickness changes with size.

(3) The method of manufacturing and hence the cost of cable varies with sizes.

(4) Capitalized losses are less at the same current for the larger size cables.

In some instances, these influences result in very little difference in the cost of cables of successive sizes. In

[Continued on page 230]

TABLE 8

Suggested Standard selection of low voltage cables for industrial power distribution systems

Non-Leaded Types R, RH, V and Interlocked armor (ACV)		Type VL	
Suggested Standard size Awg or MCM	Ratio of current carrying capacity to that of next smaller suggested size	Suggested Standard size Awg. or MCM	Ratio of current carrying capacity to that of next smaller suggested size
1		2	
3/0	1.52	2/0	1.53
250	1.28	4/0	1.30
350	1.22	350	1.38
500	1.23	500	1.24

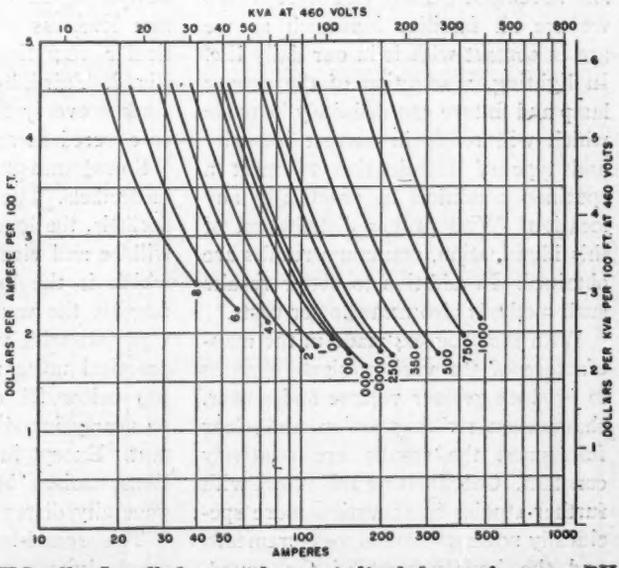


FIG. 6b—Installed cost plus capitalized losses for type RH cable used to illustrate selection of standard cable sizes. (This chart appeared in Part II)

FIG. 1—Sound level meter measures prevailing noise levels in decibels.

Selection of AUDIBLE SIGNALS

By A. A. Schuhler

Sound, like light, may be emitted from one source or many, concentrated or diffused. How to select audible signals for effective operation by areas and noise levels.

SIGNAL devices of the audible type have been in great demand and have proven their importance and value in commercial establishments and institutions over a period of years. In many instances where proper consideration and study has been given, the maximum results have been obtained. On the other hand, a great many systems have been installed on a hit-and-miss basis, and as a result have not always proven to be the most economical and efficient.

The selection of audible signals can be placed on a scientific basis not unlike that accomplished in other branches of the electrical industry. One example is the lighting field which has developed greatly and with which we are all familiar inasmuch as we are in contact with it in our daily life. In lighting, a selection of the proper lamp and fixture can definitely be made which will result in correct intensity and type of illumination to meet a specified condition in practically any location. With proper distribution of this illumination, maximum results are obtained. In addition to better results such methods also mean lower costs.

With the progress made in the manufacture of the various signal devices to produce greater volume and power, sharp even striking action and clear full tones, the results are relatively constant. Coordinating this effort with further studies in acoustics, more specifically noise and sound measurements, and the improvement of the sound-level meter, great strides will be made in improving audible signal systems.

The American Standards Association and the Acoustical Society of America have developed standards with reference to sound-level meters, their design and response. In addition they have compiled formulas and tables which greatly simplify the problem of producing the desired results. The value of these in their association and application to signal systems are shown hereinafter.

The procedure to be followed in selecting proper audible signals for a given project may be summed up by taking three steps. First, determine the noise level of a given area by the use of a sound-level meter, or from the table in Fig. 2. Second, select the audible signal device having the correct loudness and tone for the particular conditions from the table in Fig. 3. Third, locate the audible signal devices evenly throughout the area to be covered as suggested in Fig. 5.

Sound measurements are expressed in decibels. The higher the number of decibels, the louder the sound or noise will be and vice versa. Zero decibels, which is the lowest level, represents roughly the weakest sound audible to a person with very good hearing. In practical noise measurements a reading below 24 decibels is considered so nearly inaudible as to be unimportant. Except in unusually quiet locations, noises below 40 decibels are generally disregarded.

The sound-level meter, also commonly known as the decibel or noise meter, is a device for measuring the amplitude of rapid alternations in the air pressure. When these alternations occur within a certain range of frequencies they effect the ear and therefore are known as "noise" or "sound". This instrument is intended to provide a simple means of obtaining objective measurements which can be correlated with the response of the average ear. While the sound meter is not perfect in this respect, it is a most useful device, and without a doubt the best thing for its purpose so far devised.

A typical sound-level meter manufactured by the General Radio Company is shown in Fig. 1. This instrument is simple to operate. It consists chiefly of three main controls and indicators which are used in taking the readings. The first of these is a knob marked "Weighing" and provides a choice of three frequency characteristics. The second is a knob marked "Decibels" which shifts the sensitivity of the instrument in steps of 10 decibels. The third is an indicating meter calibrated over a range of approximately 16 decibels which in effect interpolates between the readings of the meter and is added to that of the decibel control. In addition a microphone is included to pick-up the sounds and the noises under study and observation.

Accurate results are obtained by taking a meter reading of the noise prevailing at the location where the signal is to be installed. Other readings should also be taken at other points in the same room so that proper consideration will be given to the even distribution of the sound delivered by

[Continued on page 227]

Db. Decibels	A.S.A. L.U. (x 1000)	Locations
110 To 125	215.00 To 875.00	Hammering on Steel
110 To 120	215.00 To 556.00	Heavy Machine Shop
105 To 120	138.00 To 556.00	Boiler Factory
100 To 120	88.00 To 556.00	Punch Press Room
100 To 110	88.00 To 215.00	Light Machine Shop
90 To 110	38.00 To 215.00	Heavy Assembly Room
85 To 100	25.00 To 88.00	Heavy Street Traffic
80 To 105	17.10 To 138.00	Shipping Room
80 To 100	17.10 To 88.00	Light Assembly Room
75 To 100	11.40 To 88.00	Stock Room
65 To 70	5.870 To 7.950	Stenographers Room
50 To 65	2.20 To 5.870	Average Street Noise
50 To 60	2.20 To 4.350	Average Office
40 To 50	.975 To 17.10	Quiet Office

FIG. 2—Typical noise level readings for various areas

* Db. Decibels	* A.S.A. L.U. (x 1000)	Types of Signals	Character & Tone
160	17000.00	Air Horn	Piercing Air Trumpet Tone
155	10000.00	High Powered Horn	Resonant, Deep, Air Tone
140	4000.00	Small Siren	Startling Shrill
138	3500.00	Vib. Horn-Megaphone	Vibrant Horn Tone
136	3000.00	Vib. Horn-Drum, Short, Two-Way	Vibrant Horn Tone
135	2800.00	Vib. Bell 12 in.	Resonant Vibrant Ringing Tone
134	2300.00	Vib. Bell 10 in.	"
133	1700.00	Vib. Bell 8 in. Single Stroke Bell 12 in.	"
129	1300.00	Vib. Bell 6 in. Single Stroke Bell 10 in.	"
126	1000.00	Single Stroke Bell 8 in.	"
125	900.00	Vib. Bell 4 in.	"
124	800.00	Single Stroke Bell 6 in.	"
123	700.00	Single Stroke Bell 4 in.	"
121	600.00	Vib. Bell 3 in.	"
118	450.00	Chime, Large	Mellow Tone
116	400.00	Single Stroke Bell 3 in., Buzzer	Resonant Vibrant Ringing Tone

*Readings Taken at Source of Signal.

FIG. 3—Sound characteristics of conventional types of audible signals.

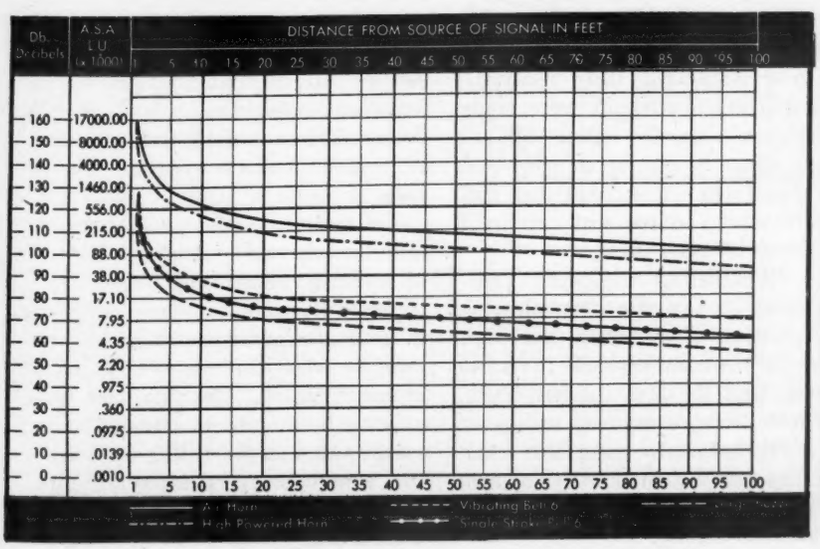


FIG. 4—Sound levels of audible signals related to distance from the source.

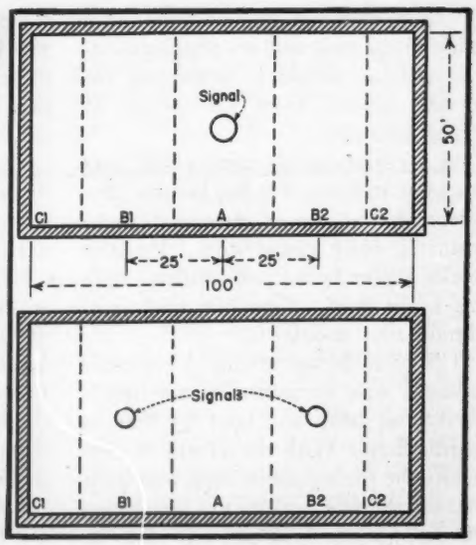


FIG. 5—Audible signals should be distributed evenly over the area served.

TYPICAL LOUVERALL LIGHTING installation using plastic Vinylite louvers.

LOUVERALL LIGHTING SYSTEMS

A discussion of new developments in louverall ceilings including summary of test results on efficiencies of several types of louvers.

By J. R. Chambers and E. H. Church

Benjamin Electric Manufacturing Company
Des Plaines, Illinois

NATURE intended man to be an outdoor creature. He was fully equipped to do his work in daylight. But his seeing problem was generally confined to relatively long range visual task, and his physiognomy was such as to aid in protecting his nervous system from the effects of bright sunlight.

As civilization has progressed, man has come indoors. He has become proficient in the use of precision tools, requiring close visual work. He now works longer hours and artificial light has to be used. Thus the science of illumination was born.

The first feeble attempt to replace daylight was by means of the torch, candle, oil lamp and later by the gas mantle lamp. With the advent of electricity the incandescent lamp was born, making the first real step in the science of illumination. Even with the incandescent lamp, the illuminating engineer still had point sources of light to work with and was unable to approach nature's ceiling of light that man had existed under for thousands of years.

Following the incandescent lamp were the electric discharge lamps which extended the light source. With these new lamps and their relatively low brightnesses, attempts were made to duplicate nature's ceiling by arranging lamps in continuous rows and in grid patterns. The result was still a separate light source with relatively dark areas between them.

The illuminating engineer's challenge now became the determination of a method of reducing the high brightness contrast between the rows of lamps and the area between them, to provide a more uniform ceiling of light. His effort to meet this challenge has resulted in the development of a new method of controlling light, the *louverall ceiling.*

The louverall ceiling, because of the possibilities of light control with its dramatic effects and utilitarian usage has become increasingly more accepted in the lighting field. Louvers, as defined in the illumination field, refer to a device which consists of a single or a series of vanes arranged in geometric patterns, all engaged in the function of shielding a light source. Louverall is a coined term meaning, of course, louvers over a complete area.

The technique of louverall ceilings is relatively new, although the use of existing beams and other architectural elements for lamp shielding is generally arranged to give visual comfort when the observer is facing in one direction. The step from using existing beams, etc. to actually placing louver vanes on the ceiling was natural for when observers faced all directions it soon became evident that both crosswise and lengthwise shielding was desirable.

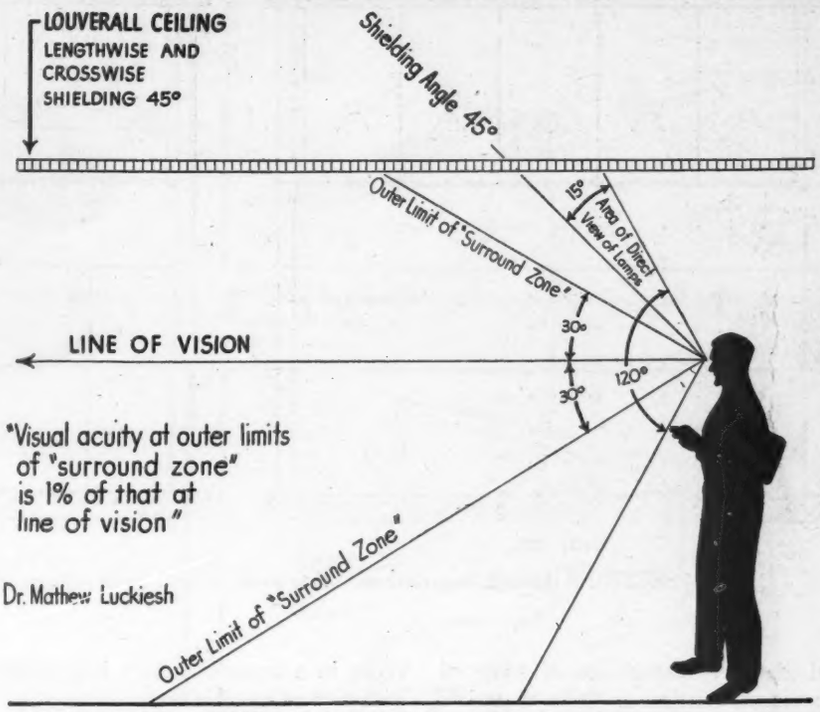
The need for shielding is demon-

strated by an analysis of the visual field chart. The visual field is described as extending about 160 degrees horizontally and 120 degrees vertically, with a small one-degree field centered on the optical axis (line of vision) in which accurate and fine detail seeing is accomplished. The portion of the visual field outside the small one-degree axis field is further limited arbitrarily to an intermediate zone, or "surrounding" of approximately 30 degrees above and below the optical axis. It is at the outer limits of this zone that visual acuity is only approximately one percent of the visual acuity in the central one-degree field. It has been found that the uncomfortable effect of excessive brightness decreases as the angular distance from the line of vision increases. Minimum comfortable seeing conditions require the elimination of high brightnesses and glare sources within this intermediate or surround zone, therefore the minimum shielding angle to protect this zone would be 30 degrees.

It should be noted, however, that this shielding angle of 30 degrees provides protection only when the eye is focused in a horizontal plane. Actually the eye is often focused from 10 to 15 degrees higher than this. In order to provide adequate protection it would appear that the shielding angle should be 45 degrees. This type of shielding then protects the entire surround zone and all but a 15 degree area at the periphery of the visual field. Visual acuity in this very small peripheral area is but a fraction of one percent of the visual acuity in the small one degree optical axis field.

To shield the entire visual field would require a shielding angle of 60 degrees. Such complete shielding would increase material cost 75 percent over the same system having 45 degree shielding, and would merely protect a small peripheral area of low visual acuity. Thus, a shielding angle of 45 degrees has been selected as a sound compromise between comfortable shielding, sound economics and illumination efficiency.

The practice of shielding in one direction only has been followed where the line of vision is in but one direction. A major reason for this is that the lamp is less bright when viewed along the lamp than when viewed crosswise. However, in this modern world where the line of vision is multi-directional, both lengthwise and crosswise shielding is certainly justified.



COMFORTABLE SEEING is provided by louverall ceiling lighting having 45-degree shielding.

ILLUMINATION DATA ON LOUVERALL LIGHTING

Based on Tests in an Experimental Office

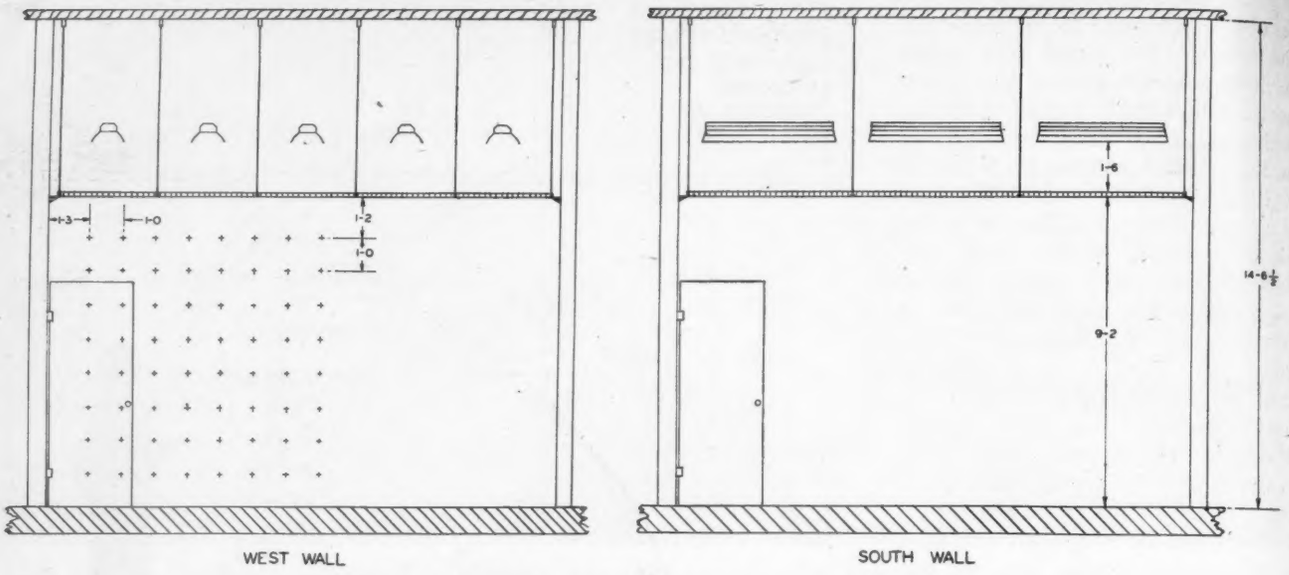
Louver Cells 2" x 2" x 2"
Crosswise and Lengthwise Shielding 45°

Louver Ceiling	Efficiency of Material		Average Footcandles	Coefficient of Utilization	Brightness Candles Per Sq. In.	% Footcandles in Terms of No Louvers
	Refl.	Transmission				
No Louvers			169	.43	Bare Lamps	100%
Plastic Vinylite	19%	71%	138	.35	1.0	81.6%
Etched Aluminum	75.5%	0	119	.30	1.15	70.4%
White Paint	74.6%	0	102	.26	0.53	60.5%
White Paint	67%	0	88	.22	0.28	52%
Black Paint	4.1%	0	51	.13	0.025	30%

The size of the louver opening and the height of the vanes are merely geometric relations to the angle of shielding desired. For example, an opening 2 in. by 2 in. with 2 inch high vanes would give a shielding angle of 45 degrees both lengthwise and crosswise; and an opening 2 in. by 8 in. with 2 inch high vanes would give a shielding angle of 45 degrees one way with a shielding angle of 15 degrees the other way.

Personal opinion, of course, will do much to determine the size of the louver opening desired. However, it has been found that in complete louvered areas an opening 1 in. by 1 in. becomes intensely monotonous. An opening 2 in. by 2 in. seems to be a satisfactory compromise. Openings much larger than this tend to destroy the apparent continuity of the ceiling.

Louverall ceiling installations, both in the field and in the laboratory, have been made using the following materials: wood, steel, aluminum, plaster



SECTIONS through experimental office used to test louver ceilings made of different materials.

and glass. A knowledge of some of the characteristics of these materials will be helpful in designing complete louverall ceilings.

Wood is relatively economical material and is easy to work with; however, even with good painting maintenance it has a tendency to warp. It is not easy to clean and unless the painting is kept up it soon has a faded dull appearance. Use of wood in thin strips to avoid wide dark lines at the bottom edge of the vanes tends to spoil the appearance of the ceiling.

Steel of course will not warp from moisture, but must be painted frequently to keep up appearance and efficiency. Weight also is a major factor in designing a steel louver ceiling.

Etched aluminum, if alzak treated, will last indefinitely and be fairly easy to clean. Its light weight is also an advantage.

Plaster strips have the disadvantage of being difficult to clean and must be of considerable thickness for structural purposes. Plaster louvers tend to have the dark lines at the bottom edges of the vanes which spoil the appearance of a well louvered ceiling. Plaster also must be painted frequently to keep up its appearance.

Glass, although impractical from a fabrication and safety point of view, has one feature that the other materials do not have. Because it is translucent, a louvered ceiling of glass has an opalescent beauty that an opaque material never can obtain. Glass can also render faithfully the color of the light source, spreading it through the vanes in a manner that is impossible with opaque materials.

With the exception of glass the other materials have been used in many installations. The majority of the installations have required detailed drawings, carpenters, iron workers, plasterers and the like. In view of this a louverall ceiling would appear to be a major construction job.

Some time ago a survey of louver ceiling systems indicated that a need existed for a louver ceiling that could be put up in multiples of standard sections by an average electrician and mechanic. The louvers should also have the following properties: lightness of weight, will not warp or shrink, be translucent, have permanent finish, render color faithfully, be easy to clean, readily fabricated and economically practical. However to find a material that would meet the desired material specifications seemed impossible until the lighting engineer turned to the plastic industry. After a period of several years a new plastic formula was derived which seemed to give the results sought for.

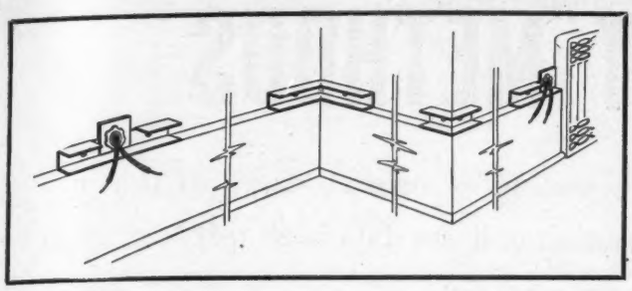
This material, Vinyl Chloride Acetate, will not shrink, is light in weight, has a light transmission of 71 percent and a 19 percent reflection factor, and is easy to clean. Because of its transmission characteristics it gives a glowing appearance that is not obtainable with opaque material. It can be sheared and punched, is easily welded and is relatively economical.

An analysis of the installation problems indicated the need for standard prefabricated frames along with necessary fittings and louver sections which would be available to the industry. These prefabricated parts should be made in various sizes so that multiples of these sizes would accommodate all room dimensions. The design of the louvers, frames and fittings should be such as to afford a simple assembly and installation in the field. It was believed that the method of suspending this system should be flexible enough to accommodate suspension from any type of ceiling, and yet simple enough for the average mechanic to install. In addition to these requirements, the factor of maintenance had to be seriously considered. The louverall system should be such that the lighting units are readily accessible for maintenance.

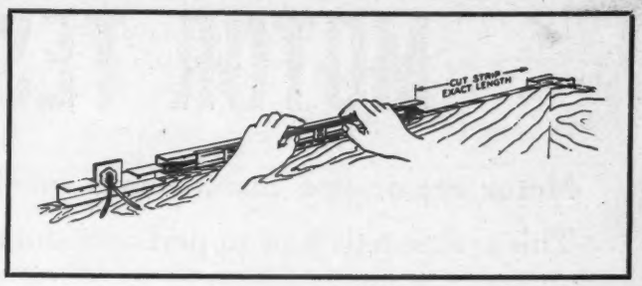
After considerable design and development work it was found that "U" shaped steel supporting channels with suitable couplings could be easily assembled into a support framework for a louverall system in the field. This framework can be supported by steel rods with simple brackets, or spring wing toggles, etc., and can be suspended from practically all types of ceilings by the average mechanic. Plastic Vinylite louvers and steel supporting channels have thus been combined to provide a new type louverall ceiling having those desirable features which were found most needed.

The standard frame size chosen was 3 ft. by 5 ft. The reason for the selection of this size was to have a frame size large enough so that the steel work would not detract from the ap-

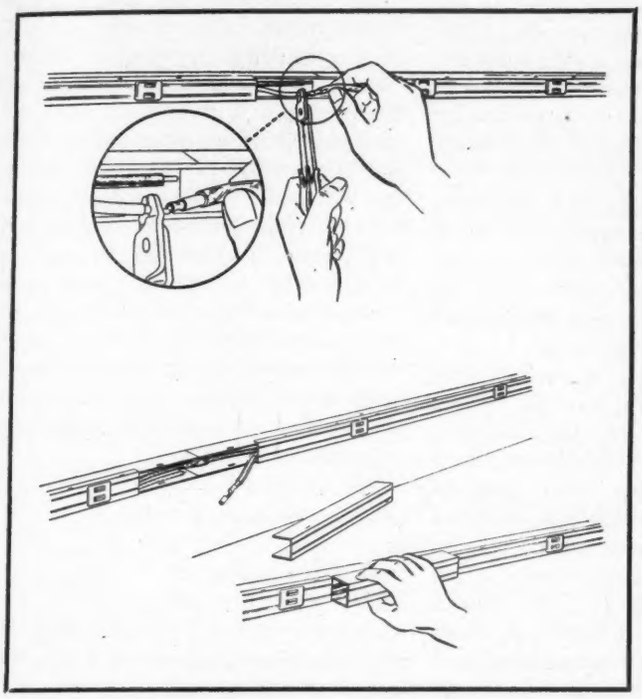
[Continued on page 154]



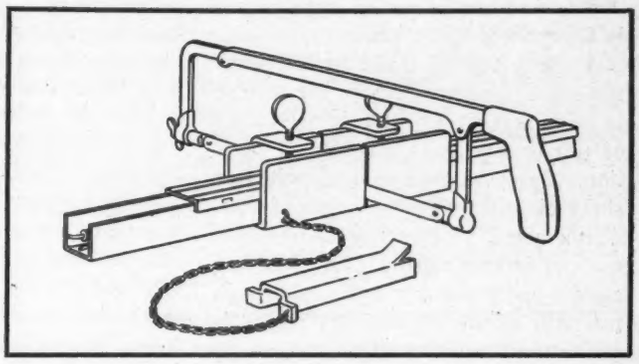
1 Circuit feed enters at center (or end) junction box. Elbows and bridging of boxes are installed.



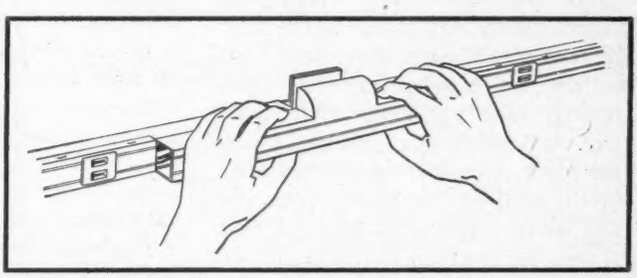
2 Strip is installed between fittings and end piece measured for cutting.



4 Wires are stripped to gauge and barrel connector crimped to the conductors. Insulator tube is slid over connector and taped in place. Coupling cover is snapped in place.



3 Cutting gauge and hacksaw are used to cut to measured length needed to finish run.



5 Center feed needs 4 inches of conductor, wires are crimped and insulated, cover applied.

Squeeze Connections Speed Installation

A new method of jointing in surface raceways marks a trend in wiring techniques. Announcement of a new multi-outlet assembly, National Electric Products Company's Plug-in Strip, points up a growing specialization in installation methods in electrical construction work. The new multi-outlet assembly is of conventional proportions and outlet spacing.

Spring contact clip receptacles are pre-wired with No. 12 in standard strip lengths of 6 and 3 feet. For cutting and fitting in the field a special jig is used which provides accurate and square cuts in the raceway and close-tolerance cutting of the cover strip to match the fittings. The design is such that the 2½-in. capacity cutback is automatically guided once the basic raceway length is established.

The wires are cut through with the raceway. A guard protects the wires when the cover plate is cut. Connections are made with small copper barrel connectors with the same conductivity as a No. 12 wire. A specially designed crimping tool for applying the connector contains a wire cutter, insulation stripper and measuring guide and a set of crimping jaws.

After cutting the raceway the wires are stripped back ¼ inch by setting the wire in the tool to a fixed gauge. The barrel connector is then crimped tightly to the wire. The tool is so designed that a full and tight connection is certain when the jaws are fully closed. The pressure necessary to close the jaws on the connector is enough to "flow" the metal together.

A plastic insulating sleeve is then pushed over the connector and wire leaving the remaining side of the connector exposed. The end wire of the next section of raceway is stripped and crimped in the same way as described above. The insulating sleeve is pushed back over the connection and taped.

According to field tests made by the manufacturer, the special tool, barrel connectors and insulating sleeve cuts jointing time to 25 percent of that required by conventional joints. With prewired receptacles and the crimp connector the assembly provides a solid conductor system from panel to outlet.

MOTOR TEST METHODS

Motor repair and maintenance involve testing at several stages of the job. This article tells how to perform shop testing and the data such tests can give.

WHEN an electric motor is brought into a repair shop, it has ceased to perform in one or more phases in its cycle of operation.

A quick test is made to determine the exact trouble. Perhaps the trouble is such that an adjustment or change of (1) brushes, (2) brushholder position, (3) operating speed of switch or short circuiter, or (4) value of condenser used, will rectify the trouble without further repairs. Or if further repairs are necessary, a final thorough test will assure us that the motor is performing satisfactorily, and at its best in all of its characteristics. Slight changes or adjustments, as noted above, will often make a very great improvement, particularly in the starting and pull-in torques of single phase motors, and can be best made while testing under load. It will be found that with single phase motors, by far the greatest number of failures occur in the starting and pull-in phases of the motor's operation, and for this reason, the dynamometer or brake used for testing should be particularly adapted to test these characteristics.

Torque Characteristics

The load to which a motor is applied requires that it have a certain minimum in its various characteristics in order to operate satisfactorily. It will be found, for instance, in motors used for refrigeration work, that if the motor drops below 250 percent in its starting torque, about 150 percent in pull-in torque, it will come back into the shop for repairs. After the motor has been repaired, if it will just start 275 percent and pull in 175 percent, it will go out and probably work, on the average job. But if this same motor, after testing and adjustments, will start 400 percent, and pull in 200 percent, it will stay out on that job much longer, than if it would only start 275 percent and pull in 175 percent.

A typical example of the value of testing is the experience of a large ice cream company, who kept a pretty accurate check on their motors. Before they bought a dynamometer for testing their motors, the average length of service of a repaired motor in the field was just over eight months. After three years use of a dynamometer, with which they were able to check, and adjust each motor to secure its maximum performance, this service had risen to over 18 months.

Proper testing equipment, therefore, is important to the repair shop to assure that the work will be done properly and will not come back. It saves much time in diagnosing trouble and is one of the best salesmen.

A test of an electric motor is a comparison between what a motor *will do,* and what we think a motor *should do.* Therefore, the very first requirement in making such a test is knowledge of the input and the output characteristics of the particular motor we are testing. If these are not available, we should at least know the average characteristics of the type or class of motors to which our particular motor belongs.

The input characteristics of a motor are the various readings in amperes, watts, power factor and voltage, taken at various stages in its operating cycle, from locked rotor, up through starting, pull in, full load, various percentages of full load from zero to maximum, or pullout torque. Considering principally single phase motors, perhaps I can best illustrate the output characteristics in which we are most interested, by comparing a motor to a mule. Suppose we have a wagon at the bottom of a hill, which is steepest at the bottom, gradually getting less steep as it nears the top, where it levels off. We hitch a mule to this wagon by means of a scale, by which we can measure horsepower. He should be exerting a one ton pull on our wagon, and on level ground at top of the hill he should be turning up five miles per hour.

Hitching the mule to the wagon, we put all the brakes on and tell the mule to get going. He pulls and tugs, burns up a lot of oats, or watts, and makes that scale read 3½ tons, but the wagon won't move. However, though he hasn't done any work, we say that he has developed a Locked Rotor Torque of 3½ times our full load torque of one ton, or 350 percent. Having settled this point, we slacken off the brake, and in most cases, the wagon should start to move, with the scale still showing up around 3¼ tons, and the mule should be able to get up to about 1 mile an hour. So the mule has a Starting Torque of 3¼ times full load torque, or about 325 percent. As he moves up the hill, the grade eases off somewhat, the torque reading on the scale decreases, and the speed of the mule increases, so that when the scale reads down to two tons, he has attained a fast walk, about three and one half miles per hour.

Starting Cycle

If we consider all of the mule's efforts up to this point as part of his "starting cycle," this 3½ miles per hour with the two ton load, which is the best load he can bring up to the speed just before he "pulls in" to a trot, of 3½ miles per hour, he has come into the running cycle of operation. If he can "pick up" this two ton load, and bring it up to full load speed, as the load is decreased to one ton, we say that he has a Pull-In Torque of two tons, or 200 percent of full load. As the load is still further decreased to one ton, or full load, his speed comes up to five miles per hour, and he trots merrily along. If the wagon starts down a little grade, the speed is further increased, so that at this point, with full speed and no load, as at locked rotor, with no speed, and all pull the mule can actually do no useful work. Starting up another grade, the scale reading gradually increases to two tons, and this is the most the mule can carry and still maintain a slow trot of 3½ miles per hour. If the load is increased beyond this point, he "pulls out" of his trot, and goes back to a walk, or back on the starting cycle. This maximum of two tons at a trot is called his Maximum of Pullout Torque.

Of all these characteristics, the most

By Howard Davies

important is the Maximum Torque, because it determines to a very great degree what the other torque characteristics of the motor will be, and also has considerable effect on the current and watts taken at various loads. In any type of motor, the higher is our maximum torque, generally the higher will be our starting and pull in torques, and the lower our maximum torque, the lower we can expect our starting and pull in torques to be. On the other hand, generally the higher is our maximum torqe, the lower our power factor, and hence the motor will take more current, particularly at loads up to 50 or 75 percent of our maximum torque. And the lower is our maximum torque, the higher our power factor will be, with less current generally at most loads. Thus, with three repulsion start induction motors we get results somewhat as follows:

	Maximum Torque	Power Factor	Start Torque	Pull-In Torque
Average motor will have	200%	70	350%	200%
Poor motor would have..	150%	80	275%	150%
Extra good motor would have	300%	60	550%	275%

The same applies to any type of a-c motor. In testing a motor, if the starting torque is low, the first thing we check back on is the maximum torque of the motor. If this is below average, we can expect that the starting torque will also be below average.

The maximum torque of the motor depends almost entirely upon the design of the main or stator winding of the motor. We will not discuss this at this time. The maximum torque of the motor can also be decreased by any of the following reasons:

(1) Poor soldering in wound rotor motors.
(2) Poor contact between necklace or short circuiting device and the commutator.

In squirrel cage motors, bad connections between bars and end rings, broken bars or end rings, or rings and bars of too high resistance are other reasons. Any of these will not only decrease the normal maximum torque, but will also result in lower full load speed, and more current draw at various loads. Worn shaft or bearings, allowing rubbing of the rotor on

POLYPHASE MOTORS

Readings of 2 hp., 3 phase, 220 volt, 6 amp motor with rotors of various resistance. NO ROTOR, 35 amps. Maximum Torque, 20%—. 1800 speed motor.

MOTOR	LOCKED ROTOR AMPS—START TORQUE		F. LOAD rpm.	F. LOAD AMPS
Low slip.....	27–28	50–75% or less	1760	5.5
Average Motor.....	24–25	100–125%	1740	6.0
High Starting Torque....	18–20	150–200%	1650–1700	6.2 6.6
Bad Rotor Bars or Rings..	10–25 (varies)	50–150	1500–up	6.–8. (fluctuates)

If the stator is not shorted, a bad rotor is about the only other factor outside of bad bearings which will affect the starting torque of the motor. With bad bearings, locked rotor amps will not be changed, but starting torque and full load rpm. and maximum torque will be decreased, full load amps and watts will be increased.

With motors with other than single squirrel cage rotors, such as double squirrel cage rotors, and automatic start motors with one squirrel cage and one wire wound winding on the rotor, such as the old Century type AS, the same general rules apply. However, with these motors, the motor at start is essentially a high resistance rotor, with starting currents as low as 40 to 50% of no rotor ampere readings, in the AS type motors, with starting torques of 200% or better. When these motors are up to speed, they are essentially a LOW RESISTANCE rotor, with high full load speed, (about 1750) and normal load current.

SPLIT PHASE MOTOR—EXAMPLE

Readings of typical ¼ hp. split phase motor, 3½" diameter, 2" long (core), with about 340 turns #17 wire in running winding, NO ROTOR 26 amps, and various starting windings. FL amps, 4.4. Maximum Torque, 200%. Locked Rotor running winding only 18 amps.

STARTING WINDINGS APPROXIMATE	Locked Rotor Starting Both Windings Torque		
250–300 turns #23 to #25..	22–23	75–100%	Will conform with NEMA Locked Rotor current, but will not have too much starting torque.
200–225 turns #22 to #24	28–35	125–200%	This is a typical short hour washing machine motor.
Same starting winding with 100 Mfd. condenser.	18–19	125–150%	Capacitor will give about the same starting torque, cuts down locked rotor current.
Same winding with 200 to 300 Mfd. condenser.	22–23	200–300%	
Same running winding with starting winding of 400 to 450 turns of #22 or 23 wire with 100–125 Mfd.	18–19	300–400%	The number of turns in the starting winding is main difference between split phase and capacitor start motors.
This same running winding, with a starting winding of about 2½ times 340, or from 850 to 950 turns of 24 or 25 wire, would make this a permanent split phase capacitor motor, with 5 to 10 Mfd. 830 volt oil condenser connected in the starting winding.	18	will start 10 to to 20%, sufficient for fan duty.	Maximum torque will be increased from 200 to about 225–250%. Full load amps will be reduced from 4.5 to 3 or 3.5 amps, according to capacitor used. No switch is used in starting circuit.

Note that in split phase motors, the lesser the number of turns in the starting winding, the better is the starting torque. The best wire size for the start is about six sizes smaller in the starting winding. For capacitor start motors, the number of turns in the starting winding will be from 125 to 140% of the running winding turns. Note that with 400 turns in the starting winding, we get the same starting torque with a 100 mfd. condenser, as we get with 200 to 300 mfd., and only 200 turns in the starting winding. We also find, that in capacitor start motors, if we increase the size of wire in the starting winding, we can get higher starting torque, using a larger capacitor.

AVERAGE CHARACTERISTICS 110 VOLT 1800 RPM SPLIT PHASE MOTORS

HP.	Amperes No Rotor	Amperes Locked Rotor		Amperes		Watts		Torque	
		Run Winding Only	Both	No Load	Full Load	No Load	F. Load	Start	Max.
1/8	12–16	8–12	12–20	2–3	2.6	50–75	200	100–150	200
1/6	16–22	12–16	15–25	2–3/5	3	60–90	250	100–150	200
1/4	23–30	15–20	20–35	3–4.5	4.5	75–125	325	100–150	200
1/3	30–40	18–25	30–40	4–5.5	6	100–150	400	100–150	200
				CAPACITOR START 110 VOLT MOTORS					
1/6	16–22	12–16	12–18	2–3.5	3	60–90	225	300–400	200
1/4	23–30	15–20	15–22	3–4.5	4.5	75–125	300	300–400	200
1/3	30–44	18–25	18–27	4–5.5	6	100–150	400	300–400	200
1/2	45–55	25–35	25–38	5–7	8	125–200	525	275–400	200
				CAPACITOR START 220 VOLT MOTORS					
1/2	22–27	12–18	15–22	2.5–3.5	4	100–200	550	300–400	200
3/4	28–35	15–25	17–30	3–4.5	5	150–225	800	300–400	200
1	30–42	18–30	20–36	4–5.5	6	150–250	1050	250–350	200
1 1/2	50–70	30–50	35–60	5–9	9	200–300	1500	200–300	200
2	60–86	36–60	40–70	7–11	12	250–400	2000	200–300	200
3	85–120	50–80	55–90	12–16	18	300–500	3000	200–250	200

The CHARACTERISTICS OF REPULSION START, INDUCTION RUN MOTORS will be approximately the same as for capacitor start motors, in the various ratings, with the exception of the locked rotor current. Whereas in capacitor start motors, this will average about four times full load current, for REPULSION TYPE MOTORS this average will be from two and one half to three times full load current.

REPULSION INDUCTION MOTOR—EXAMPLE

Readings and troubles with typical ½ hp. 110 volt, 8 amp, 1750 rpm. Repulsion start induction motor. Readings which are affected by troubles are in bold face type. No Rotor 50 amps.

TROUBLES	TORQUE			R P M		AMPS		WATTS	
	Start	Pull in	Max.	Pull in	F. Load	Start	F. Load	F. Load	No Load
A good average motor.	350–450	200	200	1300	1750	20–25	8	125–200	550
Bad short circuiter.	350–450	200	**100–150**	1300	**1500–1700**	20–25	**9–13**	125–200	550–850
Bad soldering.	**200–350**	**100–200**	**100–150**	1300	**1500–1700**	**12–20**	**9–13**	125–200	550–850
B holder out of position. Bad brushes. Com. burned. Mica high.	**0–300**	**100–200**	200	1300	1750	**10–20**	8	125–200	550
Shorted rotor.	**0–200**	**100–150**	200	1300	1750	**10–30**	8	125–200	550
Shorted stator, only a few turns.	350	200	200	1300	1750	**20–30**	**8–12**	**200–400**	**600–800**
Pull in, rpm. low.	350	**75–175**	200	**900–1200**	1750	20–25	8	125–200	550
Bad bearings.	**0–300**	**100–150**	**150**	1300	**1700–1725**	20–25	**8–12**	**150–300**	**600–800**

With bad soldering or bad short circuiter, the amps and watts at all loads, and particularly at full load, will fluctuate, at times considerably.

With Repulsion induction motors, such as General Electric-Type SCR, the position of the brush holder is very critical, as it effects all of the characteristics of the motor. The position which gives the maximum starting torque may result in a full load rpm. of over 1800, but may also give a high full load amps and watts, and at no load, the motor will take more than no load current, and may attain speeds up to 3000 rpm. in an 1800 motor. The best brush position is a compromise, of the best starting torque which will give normal full load current.

the stator will also produce much the same results.

The starting torque of single phase repulsion induction type motors will normally be from 150 to 200 percent as much as the Maximum torque. Note figures for motors above. There are a number of factors which can affect these figures. Some of these are;

The position of the brushholder.

The material of which the brushes are made. (We tested six grades of carbon from one manufacturer in one motor, and the starting torque of this motor varied from 250 up to 550 percent.)

The brush spring tension.

The condition of the commutator as to surface contact.

The starting torque of polyphase motors is effected mainly by two factors. First the maximum torque of the motor, and second the resistance of the rotor. The comparative value of this rotor resistance can be roughly determined by the relation between our NO ROTOR AMPERE reading, and the LOCKED ROTOR AMPERE reading. Thus, if we have a 2 hp. 2 phase 220 volt motor, with a NO ROTOR AMPERE reading of 30 amperes which would indicate a maximum torque of close to 200 percent, we would get results somewhat as follows with different rotors. With a locked rotor of about 27 or 28, our starting torque would probably not be over 50 to 75 percent. If our locked rotor was about 24 or 25 amperes, we would start about 100 percent. And with a locked rotor of 21 or 22 amperes our motor would probably start about 150 percent, while a locked rotor amps. of 16 or 16 would probably give us a starting torque of near 200 percent. The lower is our locked rotor amps, in relation to our NO ROTOR AMPERE reading, down to 50 percent of our NO ROTOR reading, the better our starting torque will generally be.

The starting torque of single phase squirrel cage motors, as in polyphase motors, depends considerably upon the maximum torque, and the rotor resistance. In split phase motors, it is also affected by the relation between the number of turns in the running and starting windings, and also the sizes of wire in the two windings. In capacitor start motors, we are affected by the same factors as in split phase motors, and in addition to these, the value of the capacitor used.

In split phase and capacitor start motors, the factors which affect the starting torque are more or less fixed. They don't wear or change, like brush contact or commutator surfaces. Therefore, the starting characteristics of these motors are more constant. They either will, or they won't. The only changeable factor in either of these motors is the condenser. We can readily change these to determine the one which will give the best results. But as long as the starting switch makes contact, these motors will start as good the day before they break down as the day they went to the customer from the shop, barring possibly bearing wear.

The pull-in torque of all of the above types of single phase motors is affected to the greatest extent by the speed at which the short circuiting device cuts in, or the starting switch on split phase or capacitor motors cuts out. This should be in most cases about 1300 to 1400 rpm. on four pole 1800 speed motors. Most trouble is encountered by these devices operating at lower than the above speeds. In repulsion start, induction run, brush lifting type motors, care should be taken that the brushes do not leave the commutator before the short circuiting device makes contact. If this occurs, there will be an interval during which no power will be developed and the motor, if it does not have enough momentum to carry it over this spot, will pump, that is, lift the brushes, slow down, brushes will go back, motor will speed up, brushes will lift, motor will slow down, and so on. On brush riding motors, if the short circuiter does not make good contact, current will continue to flow through the brushes, increasing the brush and commutator wear. To check short circuiter contact, allow the motor to come up to speed, then remove the brushes. Then gradualy apply load until motor stalls, or goes back "on the brushes." Then, allowing the motor to come up to speed, remove the brushes, apply the load until the motor stalls. This time it will stop, and note whether the maximum torque is as high as it should be.

The pull-in torque of capacitor start motors is also affected by the capacitor used. Too large a capacitor will cause the pull in and also the starting torque to be decreased.

Summarizing, the characteristics in which we are most interested are the Maximum Torque, the Starting Torque, and the Pull-In Torque, and the Full Load rpm. For input, we are interested in the Amperes and Watts taken, particularly at full load.

While in most cases, the Locked Rotor Torque is approximately the same as the starting torque, there are sufficient exceptions to this rule for me to discount the value of Locked Rotor Torque. I will cite a few.

A wound rotor single phase motor with only one or two shorted coils will show a locked rotor torque that will vary from zero to several hundred percent, according to rotor position.

Some repulsion type motors, particularly the older ones with comparatively few commutator bars, or ones with poor brushes, dirty commutator or high mica may show a locked rotor torque that will vary from 200 percent to 400 percent in different settings of the rotor.

Squirrel cage motors, single or polyphase, with certain combinations of slots in the rotor and stator will produce locked rotor torques that will vary considerably with position.

In split phase motors, the centri-

[Continued on page 188]

This is a sample of tests and record kept.

Motor. Gen Elec Model 5 KCJ 204-H-1. 1 1-2 hp. 1 phase 220 volt 6.83 amps. 1710 RPM.
Diam Core 4.500 in Length 2 1-2 in D x L 11.25 36 slots. Running winding, skip 1 slot, 10 16 22 30 turns #15 wire. Total 312 turns, connected series on 220 volts. Starting winding skip 2 slots 20 32 42 23 turns #19 wire. Total 468 turns, connected series.

NO ROTOR AMPS 56 on 220 volts (running winding only)
RUNNING TEST on 220 volts
RUNNING WINDING ONLY **WITH 10 mfd. Condenser in starting**

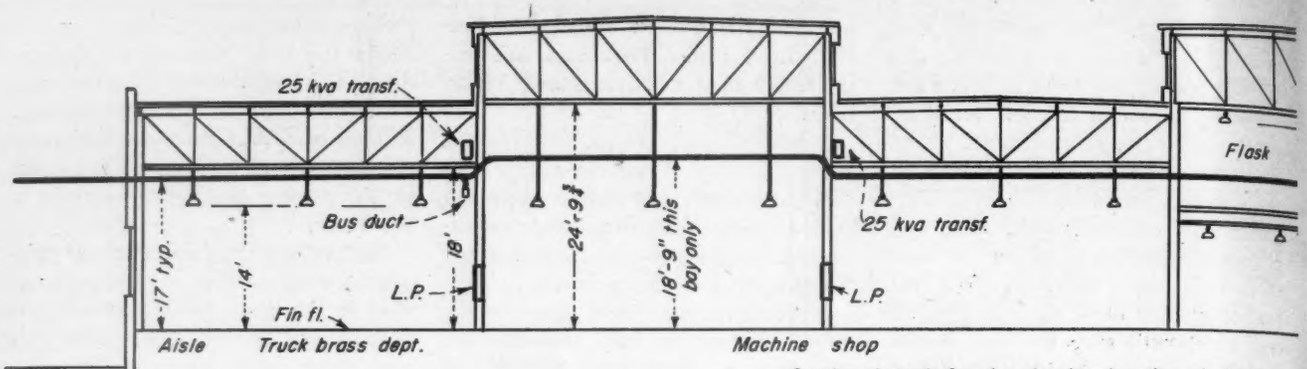
Load	Amps	P Fac.	Rap M	Watts		Amps	P. Fac.	Watts	RPM
0	7	20	1780	250		6	30	300	1790
25	7.5	50	1760	700					
50	8.4	60	1740	950		7	70	950	1740
75	9.6	72	1720	1300					
100	11	79	1680	1650		9	82	1500	1700
125	12.5	82	1640	2100					
150	16	82	1600	2500		12.5	88	2250	1640
175	22	82	1520	3500	200%	20	86	3750	1500
			WITH 20 MFD CONDENSER In Start.						
0	4.5	45	1790	350					
50	6	76	1750	850					
100	8	92	1720	1450					
150	12	92	1660	2250					
200	17	92	1520	3250					
215	21	91	1460	3750	Max Torque				

TEST ON Gen Elec 1½ hp. Motor.

Starting and pull in Torque with various condensers in starting Circuit.

Condenser Mfd.	Start Torque	Pull in Torque
50	85	125
75	190	175
100	225	190
125	275	190
150	300	175
175	325	150
200	300	125
250	275	100
300	225	75

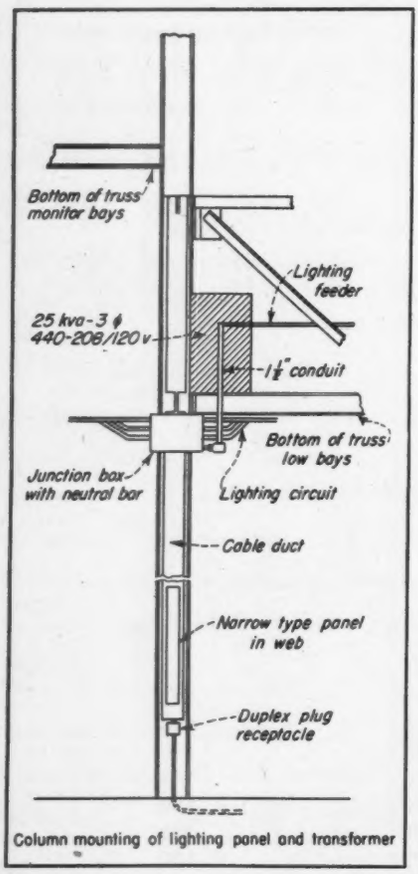
This shows that there is a certain value of condenser which will give the maximum starting torque. But this may not be the condenser which will give the best pull in torque. A compromise between the two is the one to use. This motor was equipped with two 240-260 mfd condensers connected in series, which gives us about 125 mfd. Adding to these the 20 mfd. 330 volt oil condenser which is connected permanently in the starting circuit, we have a starting condenser value of about 145 mfd., which starts about 300% and pulls in 175% of full load torque.



Section through foundry showing location of 440 volt

POWER FEEDERS traverse the foundry at heights which vary in accordance with elevations of

POWER PLAN for FOUNDRIES



Column mounting of lighting panel and transformer

TRANSFORMERS for 120/208-volt current are mounted adjacent to structural columns above lower chords of roof trusses. Narrow type lighting panels are mounted in column webs directly beneath transformers.

Progressive industrial methods and improved working conditions existent in modern Pennsylvania casting and molding plant depend on electrical distribution system installed by the Edward J. White Co.

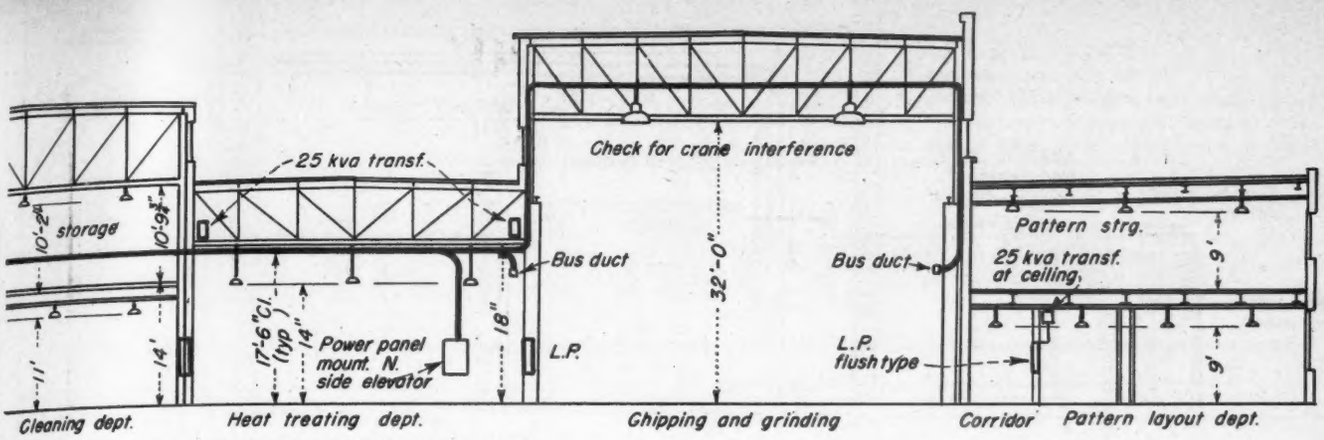
By Hugh P. Scott

PROGRESS in the foundry industry is forcefully evident in the modern casting and finishing plant recently completed for the National Bearing Division of the American Brake Shoe Company at Meadville, Pa. For there, with the introduction of revolutionary industrial processes and improved working conditions, the many operations connected with casting, molding and machining are now being completed with precision, efficiency, safety and employee-comfort formerly unattained by the foundry industry.

Representing years of research and development, the Meadville plant places primary emphasis on electrical control and motorized operation. Many processes are completely automatic while others are remotely regulated from master control centers. Motorized doors, dust collectors, fans, pumps, unit heaters, blowers and elevators contribute to effectiveness. Monorail and crane trolley systems serve all major production areas. And welding plugs, drills, saws, grinders, sanders, planers, lathes, mills, presses, boring machines and shapers, all electrically activated by motors ranging up to 150-hp. in capacity, speed and facilitate production.

Including the 4-acre single-floor foundry structure, a two-story office building, and an up-to-the-minute power house, the plant is essentially the design product of foundry engineer George Morel who, in association with J. Gordon Turnbull, consulting engineer, planned the foundry as a model for the industry. Basing their design on industry-wide experience, they prepared equipment layouts and specified electrical requirements for liberal expansion, normal rearrangement and expected evolution. Insurance was therefore obtained for ample utility service, transformer capacity and feeder size.

Beyond this point, however, the installation of the electrical distribution



power feeders and typical elevation of lighting units

roof trusses. Feeders terminate in tap boxes for connections to power panels and busduct runs.

system was dictated by problems of construction, on-the-spot analysis, and solutions which were developed to meet the many changes which were made as the work progressed in the interest of greater overall plant efficiency. These changing conditions were successfully met by the Edward J. White Company, electrical contractors of Newark, N. J., and the installation was completed in 15 months.

Primary service at 12-kv. is delivered by overhead utility lines to pole terminals at the property line and then continues underground through fiber duct runs to the plant's outdoor substation. Cables between pole terminals and transformers are two 3-conductor, 14-kv., VC and L No. 4's, and underground duct runs are 4½-inch fiber, sheathed in concrete.

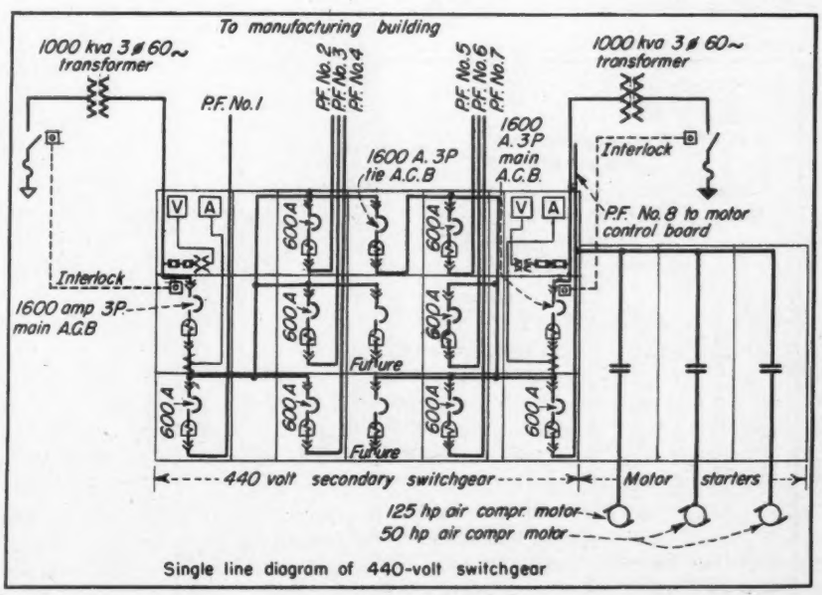
Transformers, two in number, are 1000-kva., 3-phase, 60-cycle, 12-kv./480-v. units, confined on three sides by steel mesh enclosures and on the fourth side by the northern wall of the foundry's modern concrete and brick power house. Through this wall, power is carried by twin 1600-amp. enclosed busses to the main 440-volt dead-front switch-gear cubicle installation. To permit a clear passage of busses through the wall, masonry openings are slightly larger than bus enclosures although, to insure weatherproof transition, interior and exterior transite facing sheets fit snugly around the bus structure. After piercing the wall, the two 1600-amp. busses feed into opposite sides of the secondary switchgear but are cross-connected at this point through a 3-pole automatic circuit breaker.

Also included with the 440-volt switchgear are breaker facilities for eight power feeders now in service, two additional feeders for future use, and direct connections to three air compressor motors totalling 225-hp. Of the eight power feeders in service, seven are carried through a concrete tunnel to the main foundry building, while the eighth feeder carries power to a motor control board located in the power house and controlling boiler feed, sump and auxiliary pumps, forced draft fans, coal conveyors, elevator motors and 480/120-volt lighting transformers.

On entering the main foundry building the seven power feeders bisect the plant, carried at varying heights to conform with roof-truss clearance heights above crane bays, molding and casting areas, storage sections and maintenance departments. These mounting heights vary from the initial minimum of 17 feet to a maximum elevation of 36 feet. As structural column lines are reached, feeders progressively terminate in end cable tap boxes for connections to power panels and plug-in bus-duct runs.

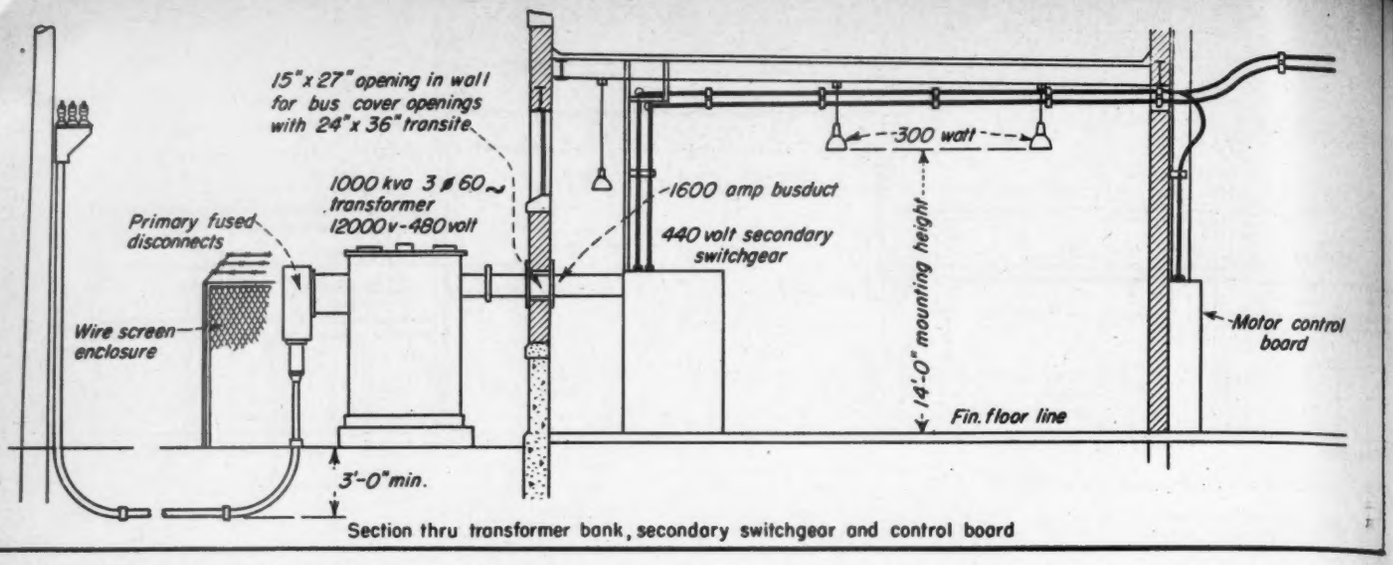
The total number of feeders therefore decreases as the 300-foot-wide plant is traversed, with all seven feeders running across the plant for the first 40 feet, five continuing on for an additional 80 feet, four reaching a column line approximately 200 feet in from the eastern entrance point, and only two extending to the final interior column line.

As feeders are terminated at these progressive column lines, runs of 600-, 400- and 225-amp. busduct are installed to distribute power north and south throughout the overall extent of the 700-foot-long manufacturing area.



Single line diagram of 440-volt switchgear

SWITCHGEAR for 440-volt distribution includes breaker facilities for present and future power feeders, direct connections to air compressors, and cross connection for outdoor transformers.



Section thru transformer bank, secondary switchgear and control board

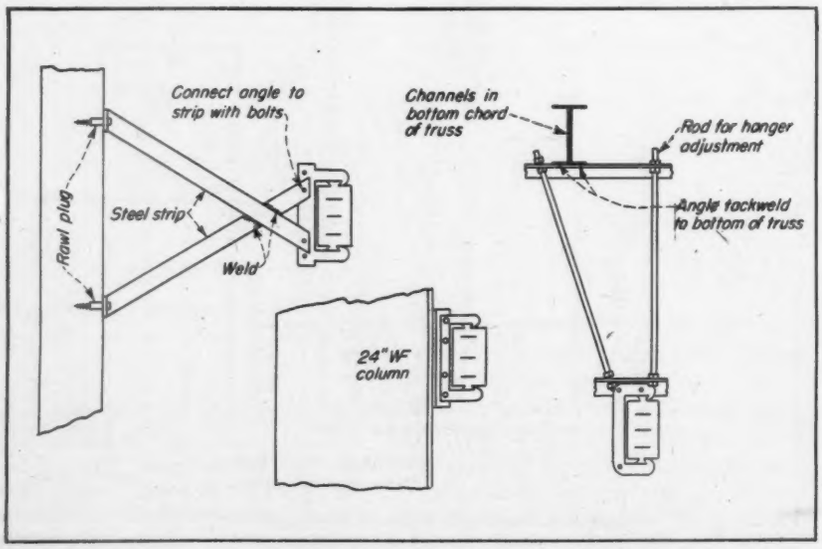
PRIMARY SERVICE, delivered to 12-kv/480-v outdoor substation through underground fiber duct, is carried by 1600-amp. busses through power-house wall to secondary switchgear.

Tapped to these busducts are branches for manufacturing, maintenance and service equipment as well as for air-cooled 480/120-volt lighting transformers and local power panels.

All motor branches are 3-wire, run in rigid conduit, with wire sizes varying from 12-gauge type R (for motors rated below 10-hp.) to 4/0 RH (for motors with ratings between 126 and 150 hp.) Branches vary correspondingly from 30- to 400-amps. All conduit between busduct and motors is installed overhead, except in the furnace area where conduit runs are installed in floor slabs to carry power to blower tilting and revolving machinery, pump units and supply fans for an underground fresh air tunnel.

In the office structure, distribution is facilitated due to the utilization of cellular metal flooring which provides wireways suitable for power, lighting, telephones and signal systems, with lighting outlets piercing the ceiling below, and receptacle and communication outlets flush with the floor.

Lighting in the foundry area is primarily by means of Holophane units. In the crane bay where heavy machine work, molding, chipping and grinding takes place, Hi-bay units with spun aluminum covers over prismatic reflectors behind 750-watt lamps are mounted at heights of 32-feet. A single row of Lobay prismatic industrial reflectors with 500-watt lamps are mounted at heights of 16.5-feet on 15-foot intervals in front of and above the furnaces, and these same units also are used generally throughout the other manufacturing areas with mounting heights varying in accordance with roof-truss elevations, and lamps of either 200- or 300-watts, depending upon utilization of areas and lighting intensities desired. Approximately one fourth of the fixtures are suspended from trolley duct, with the remaining units either supported by messenger cable or (on some loading platforms) mounted to roof purlins.



BUSDUCTS, both feeder and plug-in types, are mounted by a variety of methods and are used extensively to distribute 440-volt power throughout the manufacturing areas of the foundry structure.

In the adjacent two-story office building, containing general office space, locker rooms, a first-aid station, kitchen, lunch room, laboratories and drafting section, illumination is essentially fluorescent, mounted as single units or in end-to-end runs of from two to eight luminaires. Fluorescent fixtures are principally Holoflux units, both ceiling recessed and surface mounted varying with location, and containing either 2 or 3/40 watt lamps per 4-foot section depending upon utilization. Incandescent illumination is used for stairways, exits and storage.

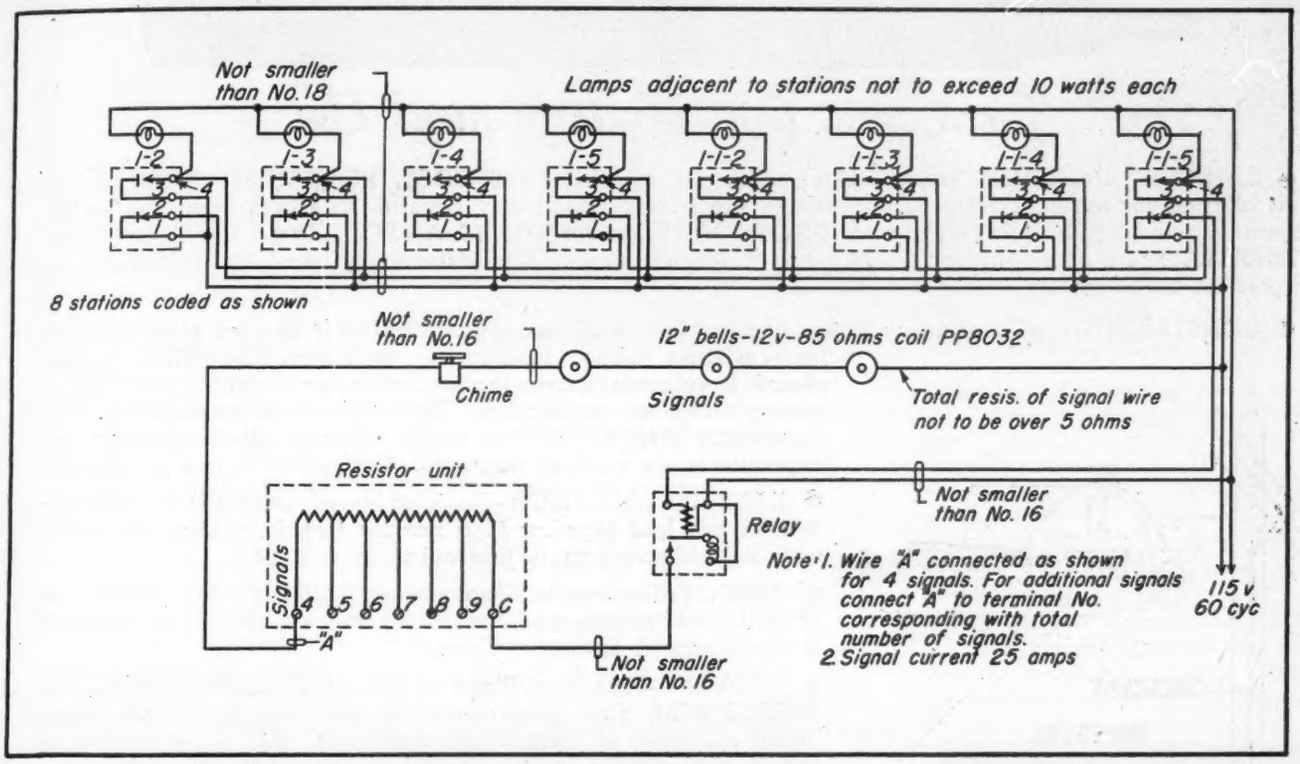
Exterior illumination consists of dust-proof wide-spread aluminum and ribbed-glass enclosures mounted over doorways, standard yard lights to illuminate railroad sidings and the grounds immediately surrounding the plant, and 1000-watt heavy-duty medium-spread floodlights, pole-mounted in pairs over the 200-car parking lot.

Lighting panels, 13 in all, control 236 circuits ranging from 20- to 35-amps. each. Lighting panels are narrow column types, mounted in the web of structural H-columns in the manufacting area, and flush-mounted in walls throughout the office building.

The 15-month installation schedule, marked by an absence of slow-downs and work stoppages, was directed by project superintendent Charles D. Wetherbie for the Edward J. White organization and the even progress can be attributed to the combination of technical experience, available manpower, modern tools and an adequate supply of materials.

BRIEF ARTICLES about practical methods of installation and maintaining electrical wiring and equipment and up-to-date estimating and office practices. Readers are invited to contribute items from their experience to this department. All articles used will be paid for.

Practical Methods


Not smaller than No. 18
Lamps adjacent to stations not to exceed 10 watts each
1-2
1-3
1-4
1-5
1-1-2
1-1-3
1-1-4
1-1-5
8 stations coded as shown
Not smaller than No. 16
12" bells-12v-85 ohms coil PP8032
Chime
Signals
Total resis. of signal wire not to be over 5 ohms
Resistor unit
Signals
4 5 6 7 8 9 C
"A"
Relay
Not smaller than No. 16
Note: 1. Wire "A" connected as shown for 4 signals. For additional signals connect "A" to terminal No. corresponding with total number of signals.
2. Signal current 25 amps
115 v 60 cyc
Not smaller than No. 16

Wiring diagram of production line trouble call system developed and installed at Packard Motor Car Co.

A typical call station along the assembly line. When the lever is pulled down and released, the signal light above lights up (also those on all other stations) and a coded signal identifying conveyor station is relayed to bells in the maintenance departments.

Conveyor Alarm System Speeds Trouble Calls

MAINTENANCE

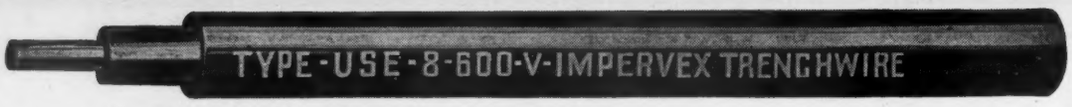
Integrated conveyor systems are the lifeline of mass production industries. To attain maximum production, they must operate smoothly. Since trouble of any kind can precipitate a "jam" that may affect the entire assembly line, most plants, particularly in the automotive field, give conveyor maintenance top priority.

At the Packard Motor Car Company in Detroit, maintenance personnel now get on conveyor trouble six times faster than previously and costly production delays are reduced to a minimum. The basis of this speedup is a coded, production line trouble call system that Packard developed and installed on its conveyor lines.

Eight coded call boxes, similar to fire alarm stations, are located at such key conveyor points as motor assembly, motor drop, front end and grille assembly, body delivery, body drop, begin-

CRESCENT

IMPERVEX TRENCHWIRE



For Lowest Cost Underground Use

● CRESCENT IMPERVEX TRENCHWIRE provides the LOWEST COST, PERMANENT underground installation for services from power line to meter, for connecting several buildings from the same service, as on FARMS, ESTATES and INSTITUTIONS and for STREET, AIRPORT, BALL PARK, DRIVE-IN THEATRES, and other outdoor lighting and power circuits. Also extensively used by INDUSTRY in ducts for underground power circuits.

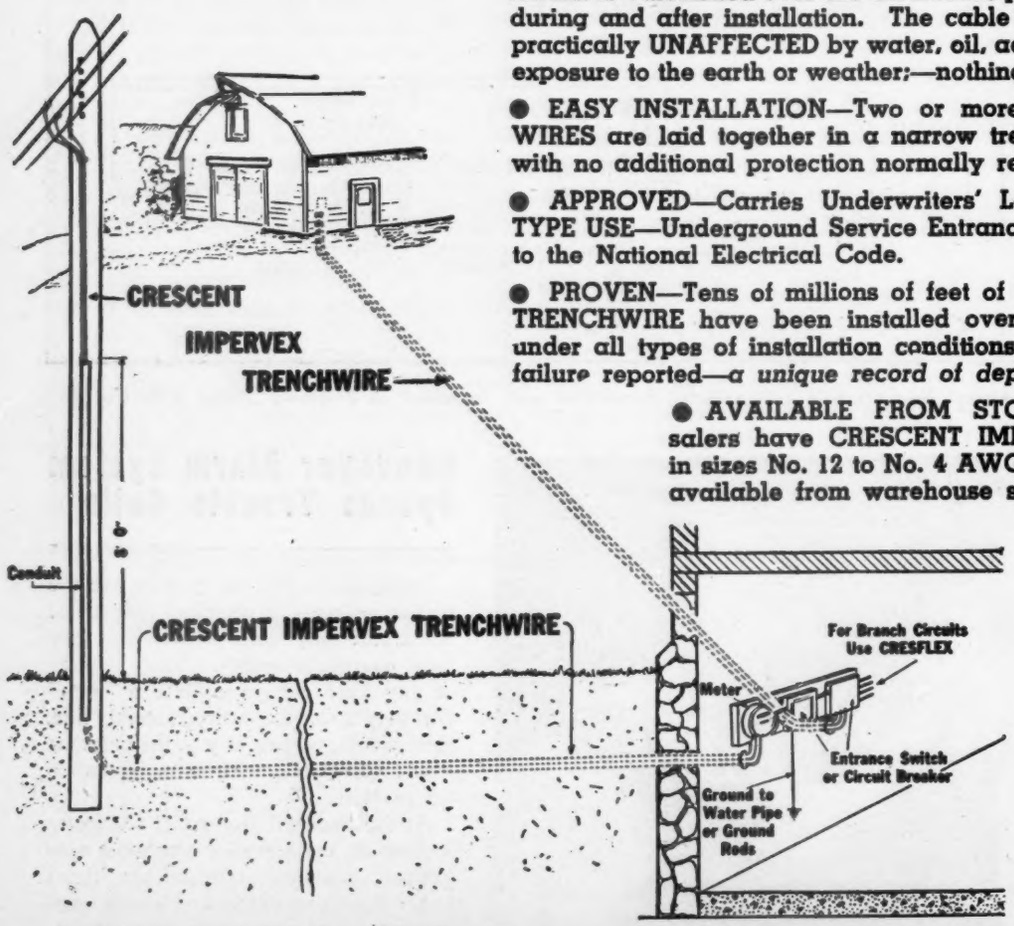
● CONSTRUCTION—The single copper conductor is insulated with IMPERVEX special moisture and heat-resisting rubber insulation. A tough NEOPRENE armor sheath is vulcanized over the insulation, protecting it from injury during and after installation. The cable is flame-retarding and practically UNAFFECTED by water, oil, acid, alkali, sunlight and exposure to the earth or weather;—nothing to rot, rust or corrode.

● EASY INSTALLATION—Two or more IMPERVEX TRENCHWIRES are laid together in a narrow trench to form the cable with no additional protection normally required.

● APPROVED—Carries Underwriters' Laboratories' Labels as TYPE USE—Underground Service Entrance Cable, and conforms to the National Electrical Code.

● PROVEN—Tens of millions of feet of CRESCENT IMPERVEX TRENCHWIRE have been installed over the last seven years under all types of installation conditions, with not one case of failure reported—*a unique record of dependability!*

● AVAILABLE FROM STOCK—Electrical wholesalers have CRESCENT IMPERVEX TRENCHWIRE in sizes No. 12 to No. 4 AWG in stock. Larger sizes available from warehouse stocks or the factory.



● BULLETIN No. 451 giving technical information on selection of proper size of conductor, etc. will be furnished on request.

CRESCENT

WIRE & CABLE

CRESCENT INSULATED WIRE & CABLE CO.

TRENTON, N. J.

ning of final assembly line and other important conveyor junctions. Loud, 12-inch alarm bells are located in the electrical, millwright and sheet metal shops; a soft audible chime is in the central maintenance office.

Should any trouble occur on the assembly line conveyor, the workman pulls the lever on the call station nearest him. This sends a coded electrical impulse that operates all alarms through a relay. Maintenance personnel from each of the departments previously mentioned are immediately dispatched to the conveyor location identified by the coded alarm. Red signal lights above each station in the system are series connected and light up when one of the boxes is "pulled". This warns other workers on the line that something is wrong with a conveyor and they should watch their production accordingly; also that no call station should be operated while the light is on.

Operation of the alarm system is relatively simple. Each call station has four terminals, two for the pilot light circuit and two for the alarm circuit. As indicated on the wiring diagram, the contact on terminals 1 and 2 operates the alarm circuit; that on terminals 3 and 4, the signal lights. When the lever on one of the stations is pulled down, a spring winds up a ratchet. When the lever is released to return to normal position, the spring unwinds and by make and break contact, sends a coded electrical impulse (to identify that specific station) to the relay which, in turn, sends it through a resistor unit to the four alarms.

The resistor unit reduces the 115-volt, 60 cycle alarm system voltage to the proper value for operating the four 12-volt bells and chime. With four signals, all resistance steps are in the circuit. As additional bells are added, the signal voltage can be increased by cutting out successive resistance steps (see wiring diagram).

Before this alarm system was installed it frequently took 30 minutes or more to get the proper maintenance crew on a conveyor breakdown job. Now pre-assigned department personnel are at the point of breakdown within five minutes.

Shipping Container For Field Office

CONSTRUCTION

Steel shipping containers, designed primarily to prevent pilferage and to facilitate material handling in marine and rail transportation, can be advantageously used on the job site as portable tool sheds or temporary field offices. By using the containers for these additional purposes, the cost of erecting and dismantling wooden structures is eliminated, the structures can be salvaged for future jobs and a fire-resistant housing for records and blueprints is available. The construction job in Eastern Pennsylvania, where the accompanying photograph was taken, made the rapid transition, from shipping container to temporary field office, merely by installing connections for light and phone service. Shipping container was manufactured by the Dravo Corporation, Neville Island, Pittsburgh.

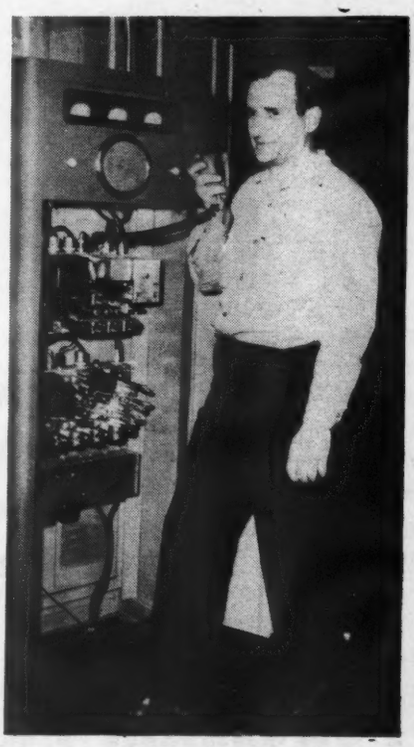
Metal shipping container can be converted into temporary tool house or fire-resistant field office by establishing level foundation and connection for light and telephone service.

Mobile Radio Unit For Service Crew

COMMUNICATIONS

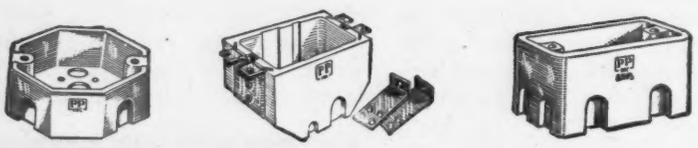
Two-way radio communication maintains contact between the main plant of Schertz Electric and Hardware Company in Minier, Illinois, and company trucks manned by installation and repair crews operating in central Illinois. Three units are already in use and all ten motor vehicles of the Schertz brothers will eventually be equipped with similar installations.

Few customers will ever hear the 50-watt transmitters operating on a frequency of 152.15 megacycles, yet the two-way Motorola system is in constant operation, transmitting questions and answers concerning availability of material, recommended repair methods and locations of customer premises. On completing each job, crews immediately contact the central office for the location of the next job, eliminating time required to locate a phone, and speeding dispatching. This is particularly helpful during severe



George Schertz establishes contact with one of his electrical repair crews by speaking into the home-office transmitter of the two-way Motorola radio installation.

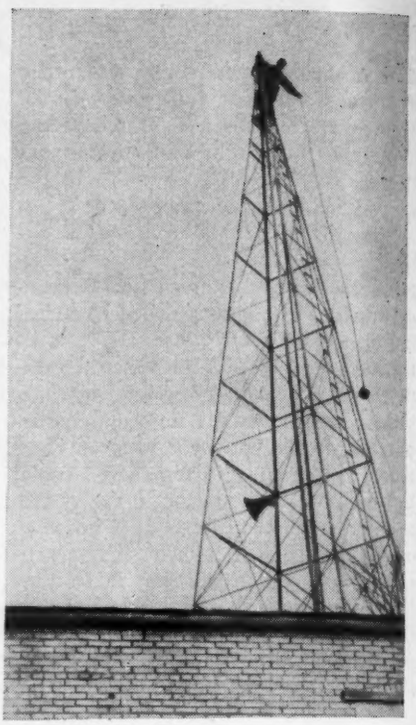
PORCELAIN
OUTLET
SWITCH
and
READY
BOXES



IMMEDIATE
DELIVERY

Phone or wire your jobber! If he does not have them in stock for immediate shipment, we will ship to you at once for him.

PORCELAIN PRODUCTS, INC.
FINDLAY, OHIO



Antenna of the Schertz Electric and Hardware Company rises to height of 151 feet above ground. Antenna is supported by hollow pipe spire and windmill storm-proof tower atop brick plant building.

sleet storms, such as those of last winter when telephone communication was greatly curtailed due to breaks in pole-mounted transmission lines. The experience gained during the storm led to the design and installation of a reinforced antenna which should withstand severe weather conditions. This antenna is 15 feet in length, mounted atop a 52-foot windmill tower and 54-foot hollow pipe spire. The tip of the antenna is 151 feet above ground.

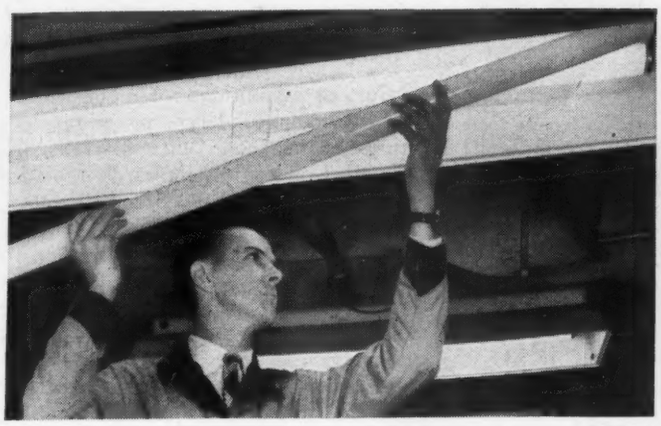
The value of the system was dramatically illustrated during the sleet storm last New Year's eve. With heat and light completely lacking at the Oak Knoll sanitarium at Mackinaw, radio communication was established with the Caterpillar Tractor plant in East Peoria over the Schertz radio, and diesel generators were promptly ordered and delivered to supply vital power for the sanitarium system.

Wire Markers Identify Circuits

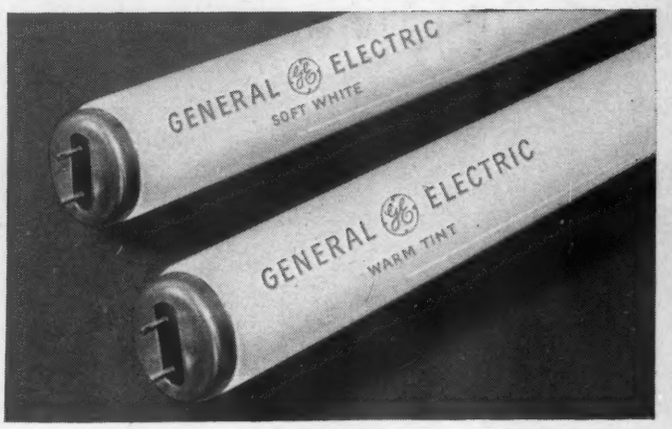
DISTRIBUTION

Rapid identification of circuits, cable connections and branch runs is possible in both new and old construction by applying adhesive labels to cables, terminals or switches. Permanent, durable, non-fading and waterproof, the labels plainly identify all electrical connections and eliminate danger of

NOW! Plenty of fluorescent lamps! Two new fluorescent lamp colors! A new 85-watt fluorescent lamp! ...ALL FROM G-E



1. SELL NEW LIGHTING JOBS—FILL EMPTY SOCKETS! For the first time ever, you can get all the General Electric fluorescent lamps you want—to sell new installations and help your customers bring their lighting back to peak efficiency. So stock up on G-E fluorescent lamps today and start making those extra sales right away.



2. FOR NEW FLUORESCENT LIGHTING EFFECTS, use these two new General Electric fluorescent colors. New G-E "soft white", developed after years of research with hundreds of color combinations, provides subtle flattery for complexions, foods, and surroundings. New G-E "warm tint" gives color values similar to incandescent light.

3. MORE LIGHT FOR THE MONEY! The new 85-watt G-E fluorescent lamp gives as much light as the 100-watt fluorescent lamp it replaces, and is designed for use with existing 100-watt equipment. It uses a rare gas, krypton, for greater efficiency.

TO HELP YOU MAKE THE MOST of these great new G-E fluorescent lamp developments, the nearest General Electric Lamp Department office will assist you in working out fluorescent lighting that will do the best job in factories, stores, offices, theaters or other places of business. For the newest developments in fluorescent, you can always look to General Electric Lamp research.

G-E LAMPS

GENERAL ELECTRIC

TESTS PROVE BRONCO CORDS AND CABLES WITHSTAND

58,585

FLEX-LIFE CYCLES

Here's proof positive that BRONCO 60 IS TOUGH

Four leading cords were put to test in Underwriter Flexing Machines. BRONCO 60 stood 58,585 Flex-Life cycles . . . as compared with its nearest competitor which failed in 4,313 cycles.

Flex-Life Sample Twisted Position

Flex-Life Sample Untwisted Position

BRONCO 60 WIRE & CABLE WITH NEOPRENE JACKET

IS TOUGH AND Flexible

TWIST IT! BURN IT! ABUSE IT! DRIVE OVER IT!

BRONCO 60 CAN TAKE IT!

TOUGH? . . . Definitely, but without sacrificing the most important factor—FLEXIBILITY. BRONCO 60 cord and cable is made to provide long, continuous, dependable service. Its extreme flexibility makes it last longer and cuts down work stoppage and delays.

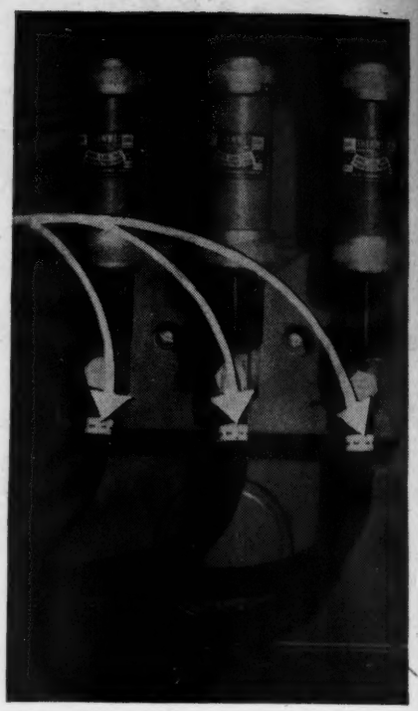
A tough, wear-resistant Neoprene jacket makes it resistant to oil, grease, chemicals, acids, cutting, sunlight, heat, chipping or abrasions. For replacement work, portable tools, electrical equipment of all kinds, there's a Bronco wire or cable to meet every requirement. Always specify BRONCO 60.

See it at your wholesaler today and learn why BRONCO 60 is the better wire to buy.

WESTERN

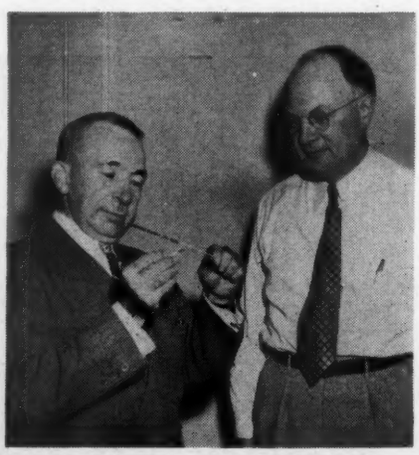
WESTERN INSULATED WIRE CO.

1001 E. SIXTY-SECOND ST. • LOS ANGELES 1, CALIF.



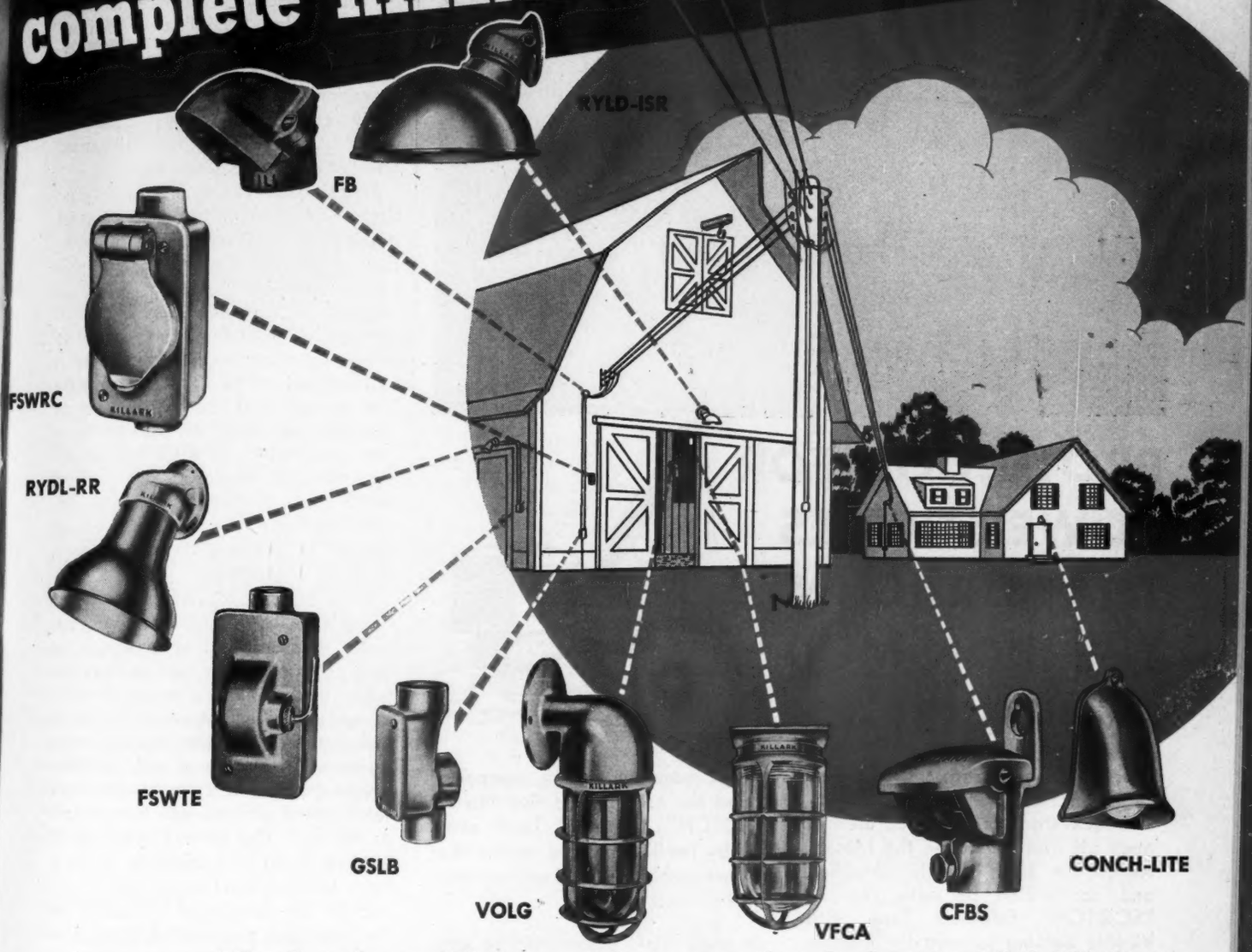
Code wire markers can be quickly applied to cables or connections, and prove to be a positive means of identification.

injury or discontinuance of service due to maintenance delays or misconnections. Since code wire markers are supplied on convenient cards, the user can quickly select the desired number, pull the tab from the card and apply it directly to the cable or connection in question. Such markers, those illustrated being manufactured by the Western Lithograph Company of Los Angeles under the name of E-Z Markers, are printed in series from 1 to 200 and can also be obtained with letters of the alphabet or code symbols approved by ASA and NEMA. Contractors and maintenance men can also order lables printed to individual specification.



George Andrae's consistent plea for a single all-purpose building wire may yet be answered. S. J. Rosch, Anaconda Wire & Cable Co., (left) shows him a newly developed flame-proof polyethelene insulated conductor.

REAL BUSINESS with the complete KILLARK REA LINE



Mile after mile, new REA lines are bringing much needed power to vital rural areas—and creating new demands for electrical installations. From outlets for machinery to lights for houses, barns and other buildings—this new development means more business for you. Go after your share by featuring Killark REA fittings—the profitable and *complete* line of fittings for rural electrification.

A few of the many popular Killark REA fittings are shown here. By concentrating on the Killark Line you are ready to supply every REA job.

Write for Killark's illustrated bulletin on Rural Electrification Fittings.

KILLARK ST. LOUIS

Killark

ELECTRIC MANUFACTURING COMPANY

Offices and Warehouses: Atlanta, Baltimore, Boston, Chicago, Denver, Los Angeles, Philadelphia, Pittsburgh, San Francisco, Seattle, Syracuse.
Offices: Cincinnati, Cleveland, Dallas, Detroit, Kansas City, Minneapolis, New York.

Vandeventer & Easton Aves
SAINT LOUIS 13, MO.

PROTECTION FOR POWER CABLES THAT DRAG IN THE IRON MUD OF MESABI

Splicing the rubber covered power cables of electrically powered dragline excavators, cranes, etc., used in open pit iron mining on the Mesabi Range, has been greatly simplified and accelerated by using No. 33 "SCOTCH" Electrical Tape with Vinylite backing to wrap the individual conductors; using 2 to 3 wraps. Over this is applied a buildup of No. 24 "SCOTCH" Neoprene Tape to approximate the thickness of the cable. Then the entire splice is given a strong outside wrap of No. 33 "SCOTCH" Electrical Tape for abrasion resistance, moisture proofing and additional electrical insulation.

One of the largest iron mining companies on the Mesabi Range, as well as numerous utility companies around the country, find that No. 33 "SCOTCH" Electrical Tape saves time by facilitating field repairs that are thoroughly efficient and extremely tough and durable.

In shaft mines where extreme conditions of moisture and dirt prevail, the waterproof, abrasion resistant qualities of No. 33 "SCOTCH" Electrical Tape make it possible to produce efficient splices without the use of a vulcanizing machine.

All this, of course, cuts maintenance costs and saves a lot of money. Write today for a sample roll and complete information.

No. 33

SCOTCH BRAND Electrical TAPE

ANOTHER 3M COMPANY PRODUCT

Made in U.S.A. by MINNESOTA MINING & MFG. CO. St. Paul 6, Minn.

MAINTENANCE OF A CITY WITHIN A CITY

[FROM PAGE 52]

recommending operational changes and billing tenants.

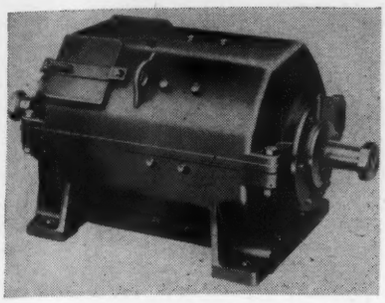
Primary electrical service is supplied by the Consolidated Edison Company at 13,200 volts through twelve separate sets of feeders. Transformation to 120/208 volts is generally effected in typical sidewalk vaults and is carried at this utilization level directly to switchboards.

Metering, previously mentioned, includes complete utility energy and totalizing demand meters and, in addition, a parallel demand system privately owned by the Center. This has resulted in tremendous savings for, through its application, it is possible to pre-set the maximum demand for each building and for the Center as a whole. The moment that the consumption in any building starts to increase at a rate which will exceed the pre-set desired demand, engineers are notified by an alarm system and they can immediately retard the rate of increasing demand by shutting down equipment of minor importance.

With central store rooms and tool rooms available for all service departments, duplication of equipment is reduced to a minimum and savings obtained in this manner can be invested in specialized equipment to facilitate the operations of more than a single division. An example of such specially-designed equipment is a telescopic work tower which rises to a height of 49 feet. The highest tower of its kind yet built, it is employed in the 4-story lobby of the International Building for the installation of lamps and the repairing or installation of electrical equipment mounted at these unusual heights. Other equipments are also constructed on a similar mammoth scale, greatly facilitating maintenance in this tremendous development where is included the world's largest theatre, largest stage, largest broadcasting studio, largest display windows, largest air conditioning units and fastest elevators.

In this development, where superlatives are common, many standard maintenance methods are inadequate, necessitating the organization of service on a scale as large as Rockefeller Center. Such organization is clearly evident. This, backed by personnel having practical know-how, modern tools and equipment, is the answer to efficient and effective electrical maintenance in this "city within a city".

Equipment News



Mill Motor

The 600 Series mill motor for heavy duty mill and crane service has been added to this line of d-c steel mill motors. It is adaptable for use totally enclosed non-ventilated or separately ventilated. It can also be furnished for self ventilation. The self ventilated machines are cooled by a fan mounted at the rear of the armature; in the totally-enclosed non-ventilated motors, the fan action is provided by the back ends of the coil supports. Special grease slingers and grooves keep grease and dust away from commutator and windings. Commutation is provided by split brushes and four interpoles. Crocker-Wheeler Electric Manufacturing Company, Ampere, New Jersey.

Lighting Units

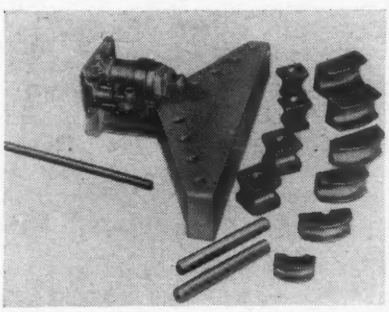
A complete series of fluorescent showcase lighting units has been added to this line. Units are known as the 21AR series and they are available in five sizes for one, two, three, four and five 15 watt fluorescent lamps. They are equipped with continuous reflectors for unbroken lines of light, and three inch conductor leads at one end. Also available is a down-wiring kit comprising an end fitting, elbow, down tubing, base flange, and armored cable connector. The Wiremold Company, Hartford 10, Conn.

Lamp Changer and Pole

An improved type of pole available with adaptable lamp changer has been announced. The steel pole is furnished in 5½ foot interchangeable sections and is so designed that sections may be quickly joined together to provide a pole of the necessary length for replacement or removal of light bulbs up to a recommended limit of 30 feet. Sections are locked together by a spring actuated button which permits quick disassembly. Each section is insulated for protection against shock from exposure or contact of changing pole or head to live wires. McGill Manufacturing Company, Inc., Valparaiso, Ind.

Building Wire

A new and improved type of rubber covered braided building wire, R, RH and RW, has been announced. Known as "Glazon" building wire, it is covered with a sheath woven of inert, inorganic fibres of high dielectric strength. These fibres, and the finished sheath, are flexible, cannot burn, are unaffected by moisture or temperature changes, cannot rot, are immune to all ordinary acids and alkalis and repellent to fungus and rodents. It is also small in diameter. It carries Underwriters approval and is available in No. 14 and No. 12 B & S. Triangle Conduit and Cable Company, New Brunswick, New Jersey.



Pipe Bender

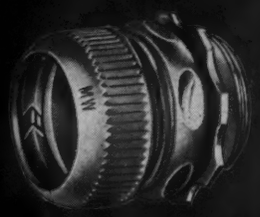
A new portable hydraulic pipe bender, known as Lightweight Champ, has been announced. Combined weight of jack and frame is 83 pounds. It has a removable hydraulic jack and open jaw construction. The 30 inch steel frame is electrically welded and reinforced. It is available with ¾, 1, 1¼, 2 and 2½ inch dies. It bends rod, flats, hand rail, electric busbar, etc. with special dies. Electric Cord Company, 30 Church Street, New York 7, New York.

Manual Starting Switch

A new line of manual starting switches for use with fractional hp. motors has been announced. They are available in five types; with general purpose enclosure; without enclosure; a combination unit and selector switch; with cast iron enclosure for wet locations, and a similar type for dusty or hazardous locations. Switches are desirable for use with fractional hp. motors driving blowers, pumps, ventilating systems, and a wide variety of similar applications. All types have a molded base of moisture-resisting insulating material which mounts and encloses the mechanism and contacts. All parts are rust-resisting and accessible wiring terminals on top of units facilitate wiring. General Electric Company, Schenectady, N. Y.

Service Drop Cable

RoPrene service drop cable, a new 600 volt service cable of the self-supporting type, has been announced. For three wire service, it is made up of two power conductors of stranded soft drawn copper insulated with a heavy wall of RoPrene, twisted around a bare neutral of hard drawn copper, which serves as a supporting messenger. Tests indicate that it withstands a continuous a-c potential of 4800 volts between insulated conductor and ground electrode for a minimum of 4000 hours without failure. Available in sizes 8, 6, 4, and 2 AWG. In localities where a bare neutral is not permitted substitution of solid hard drawn double braid weatherproof wire is recommended. Rome Cable Corporation, Rome, N. Y.



Fittings for

- Thinwall Conduit
- Rigid Conduit
- Metallic and Non-Metallic Cable
- Flexible Steel Conduit
- Service Entrance Cable
- Grounding Devices
- Lighting Fixture Fittings

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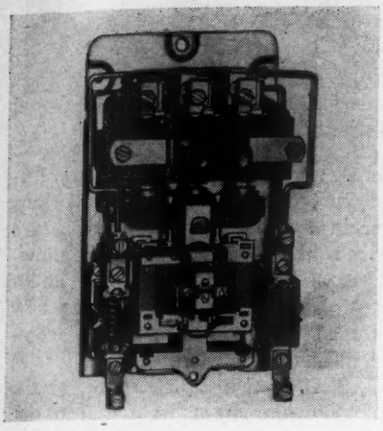
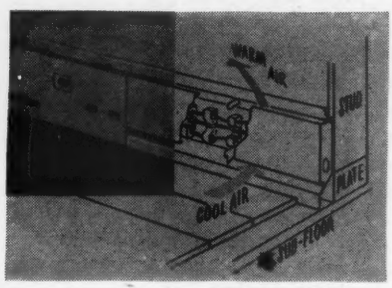


Magnetic Starter

New Bulletin 4112 size 2 a-c magnetic starters have been announced. These solenoid-operated starters are for use in general and special purpose applications where across-the-line, nonreversing starting of polyphase squirrel cage induction motors and single phase motors is permissible. They are available with open type construction for built-in or specialized controls, or with NEMA Type I general purpose enclosures. They can be controlled by separate pilot devices or supplied with local control pushbuttons or selector switches. Starters have a maximum enclosed rating of 25 hp., 440-550 volts, 3 phase, 60 cycles. Standard operating coils can be supplied for 110, 208-220, 440 and 550 volt, 25 or 50-60 cycle service. Ward Leonard Electric Co., Mount Vernon, N. Y.

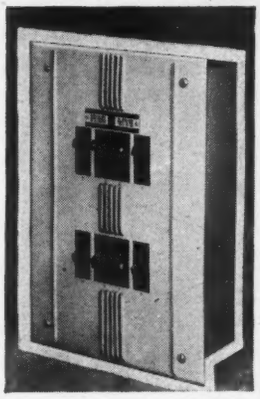


Heater

An improved electric baseboard heater has been developed. The heater is 5 inches high by 1⅛ inches from the stud, combines convection and radiation to warm the air, floors and walls. It has a capacity of 105 watts per linear foot, sufficient to heat an average size insulated home up to a design temperature difference of 70 degrees F. Units are connected in parallel on 240 volt circuits. Four standard lengths are available with a thermostat and switch control section for each room. Wesix Electric Heater Co., 390 First Street, San Francisco 5, Calif.

Motors

A new line of tube-type, totally-enclosed, fan-cooled, squirrel-cage motors ranging from 150 to 600 horsepower has been announced. Internally, the motor is divided into two isolated parts with each side having its own path of internal air circulation. Because of construction, it is possible to keep motor free of power-destroying agents which tend to clog air passages. It is offered with Underwriters' labels for 1-D or 2-G locations in ratings of 3600 rpm., 250 to 400 hp.; 1800 rpm., 200 to 300 hp.; and 1200 rpm., 150 to 200 hp. Allis-Chalmers Mfg. Co., Milwaukee, Wis.

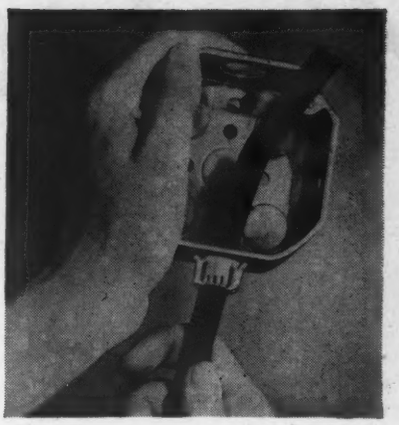


Load Centers

A new line of Quicklag load centers in basic circuit enclosures of two, four or eight is available. These make possible completely automatic protection for home wiring circuits. When circuit breaker is used there are no fuses to replace; circuit protection cannot be changed; breaker cannot be held closed against shorted or overloaded circuits; arcs are snuffed out by the De-Ion principle; its thermal magnetic action protects against tripping on harmless and momentary overloads, its time delay protection on sustained overloads and instantaneous protection on short circuit faults opens the circuit when in danger. Load center accommodates any of the following ampere breaker ratings—10; 15; 20; 30; 40 and 50. Westinghouse Electric Corporation, Pittsburgh 30, Pa.

Cable Connector

A new non-metallic sheathed cable connector for electrical outlet boxes has been announced. Known as No. 52, it is installed by pressing firmly with the thumb or tapping lightly from



the inside of the knock-out until the connector snaps into position against the outlet box. Cable is then pushed through the connector to the desired length, where it is held in position without screws or locknuts. Should removal of connector be necessary, press it together with pliers and push it through the knock-out. They are approved by the Underwriters' Laboratories. Allied Electrical Manufacturing Corporation, 1 North LaSalle Street, Chicago 2, Ill.

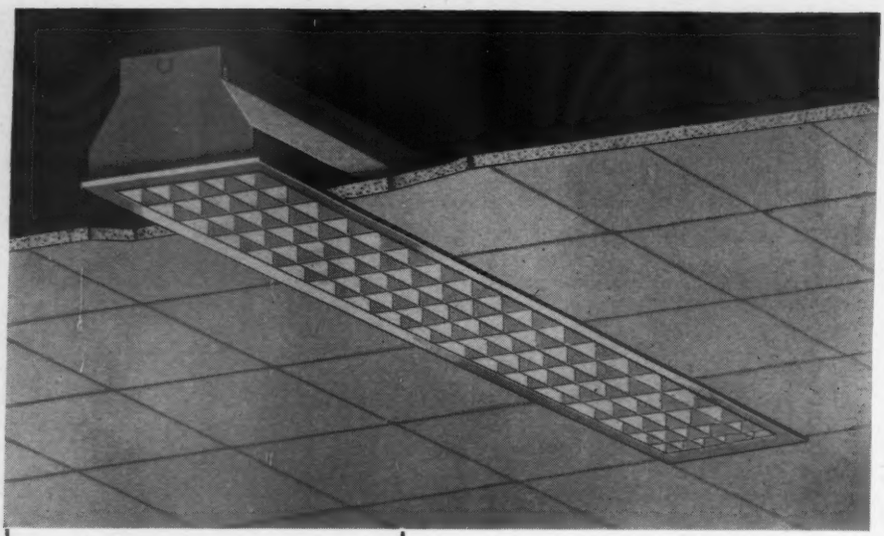
Motorgear

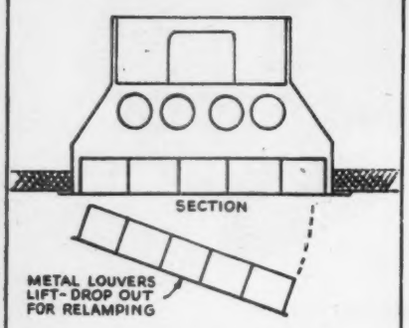
A new line of motorgears with axial air gap motor has been announced. Available in ratings from ¾ to 10 hp., these units are symmetrical in design with no separate right-hand or left-hand assemblies. Motor may also be removed from gear housing and run separately. It employs two ratios of single helical gears with hardened and shaved teeth arranged in simple gear trains. Motor and gear shafts are parallel, with centerline of motor coinciding with centerline of low speed shaft. Motorgear is suitable for horizontal mounting, but provisions can be made for wall, ceiling or angle mounting, provided shafts remain horizontal. Fairbanks, Morse & Co., 600 South Michigan Avenue, Chicago 5, Ill.

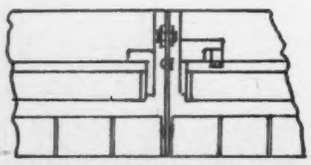
Popular Choice!

For OFFICES
HOTELS
INSTITUTIONS
KITCHENS
BANKS
THEATRES
LOBBIES

KAYLINE "LOUVRELITE" TROFFER UNITS






SECTION- SHOWING METHOD OF JOINING UNITS FOR CONTINUOUS RUNS

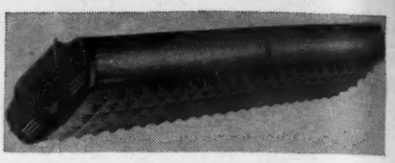
For clear, glareless, shadowless *light*, your customers will pick the KAYLINE "Louvrelite" over all! The handsome "egg-crate" louvre bottom lends a built-in appearance and is easily removed for relamping, as illustrated in the diagram at left. Note also the ease with which these units can be built in to continuous runs. Check up today on your lighting equipment needs—and call on KAYLINE to fill them.

Catalogs on Commercial, Industrial and Home Lighting Fixtures available. Write on company letterhead, please.

For over 50 years—

KAYLINE

THE KAYLINE COMPANY
2480 E. 22nd St. Cleveland, Ohio



Fluorescent Fixture

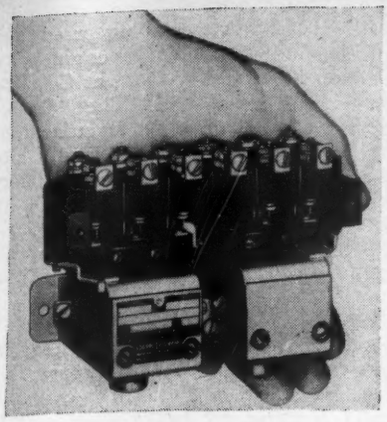
This new fluorescent lighting fixture makes available installations wherein two or four light units are incorporated in the same fixture, allowing varying light requirements without loss of uniform appearance. The new 6200-6400 louvered light fixtures combine the No. 900 louver assembly with the No. 2400 two light fixture, or the No. 4400 four light fixture into one lighting unit. Present installations may be converted to the new fixture. Unit has full depth louvers and translucent side panels of Polystyrene. Gibson Manufacturing Company, Atlanta, Ga.

Ditcher

A new "vestpocket" ditcher cuts ditches as narrow as 6 inches wide. Unit digs to a 4 foot depth. Digging buckets for 8 inches are available. It weighs 6,580 lbs. and is powered by a 47 hp. industrial gasoline engine. Maximum length is 13 ft. 9 in. and width is 4 ft. 4 in. Digging speeds range from 2.19 to 14.7 f.p.m. with digging feeds from 245 to 538 f.p.m. Excavator boom is all welded steel box type and is raised and lowered by means of self locking worm hoist, powered from engine transmission. Spoil is discharged to both sides of ditch. Crawlers, driven from forward by heavy truck type differential, are non-clogging. Left side crawler is adjustable vertically so that machine can maintain an "even keel" and dig a vertical ditch when operating along a slope or with one crawler on a curb. Gar Wood Industries, Inc., Findlay, Ohio.

Induction Motor

Silicone resins for winding insulation and silicone grease for bearing lubrication make possible a totally-enclosed non-ventilated motor in a 5 hp. four pole rating in the same frame sizes as the open motor of the same rating. This permits reductions of as much as three frame sizes from present standard Class A insulated totally enclosed motor. The efficiency, power factor and torque of such a motor are comparable to those for an open motor of the same rating. Motor is 12½ inches high and 19¾ inches long. Westinghouse Electric Corp., Pittsburgh 30, Pa.



Reversing Contactor

A new compact a-c and d-c reversing contactor designed to control small motors used in connection with small hoists, overhead doors, monorail cranes, mechanical speed changers, and other intermittent duty applications has been announced. It consists of double magnet frames and contact blocks with two three pole armature assemblies mounted on one base and mechanically interlocked. Double break silver-to-silver contacts eliminate flexible leads. Normally open electrical interlocks can be provided for three wire control by means of an interlock bar which is mounted by means of three screws. Contactors are suitable for use with a-c polyphase motors rated not more than 1 hp. and with a-c single phase and d-c motors rated not more than ¾ hp. Square D. Co., 4041 N. Richards Street, Milwaukee 12, Wis.

Take-Off Kit

The No. 200-19 take-off kit permits extension from an existing wall outlet to a run of 1900 Plugmold, wired or unwired, on top of baseboard. Consisting of a No. 251 extension adapter, a 15 inch length of No. 200 Wiremold, a No. 1989A reducing connector, and a wiring harness of No. 12 Type R conductors, this kit provides all necessary material to complete connection, making it possible to make present electrical outlets more available and to install additional outlets without channeling into walls. The Wiremold Company, Hartford 10, Conn.

New Equipment Briefs

Hobart Brothers Company, Troy, Ohio, has announced a new high frequency **stabilizer** for a-c transformer type welders, with control features to simplify inert-gas-welding. . . . Improvements have been made in Type

Contractors: get this extra profit!

General Electric's New Wall Heater Will Tack Extra Profits On All Your Jobs—Low-cost—Easy To Install!

On your next job, talk the builder into installing G.E.'s Built-in Wall Heaters.

They're not only an extra-profit item for you, but they'll do an amazing selling job for the builder. For this heater is one of the new, modern features that people look for when buying houses.

The G-E Wall Heater warms up a room fast. Can be turned on from the bedside by an easily installed, remote-control switch. It works on the radiant convection principle.

General Electric Wall Heaters are inexpensive to install. Easy to build into any wall.

There's no chance of this heater setting the wall on fire. It's been approved by the Underwriters' Laboratories, Inc.

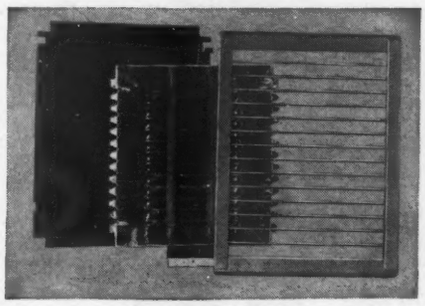
Mail coupon below for complete details.

Specifications for General Electric Built-in Wall Heater . . .

1. Comes completely equipped with tumbler switch as integral part.
2. Beautiful Hammertone gray finish—can be easily painted another color.
3. Fits flush with wall—guard projects only ⅝ of an inch.
4. Highly polished corrugated-aluminum reflector radiates heat in wide zone.
5. Protective grille of high-quality-steel wire—easily removed for cleaning.
6. Two long-life heating elements of nichrome wire—ceramic cores.
7. Rating—1320 watts, 115 volts, a-c/d-c, 4507 Btu-hr.
8. Size: 17⅛ inches high by 13⅛ inches wide by 4¾ inches deep. Wall opening, 14¾ by 11½ inches.
9. Shipping weight, 10 pounds.

Wonderfully low-priced

BUILT-IN ELECTRIC **WALL HEATER**



Heater is delivered in three parts. The wall box packed separately, so that the heater can remain safely packaged while wall box is being installed.

General Electric Co., Section 285-21
1285 Boston Avenue
Bridgeport 2, Connecticut

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GENERAL ELECTRIC

KLEINS

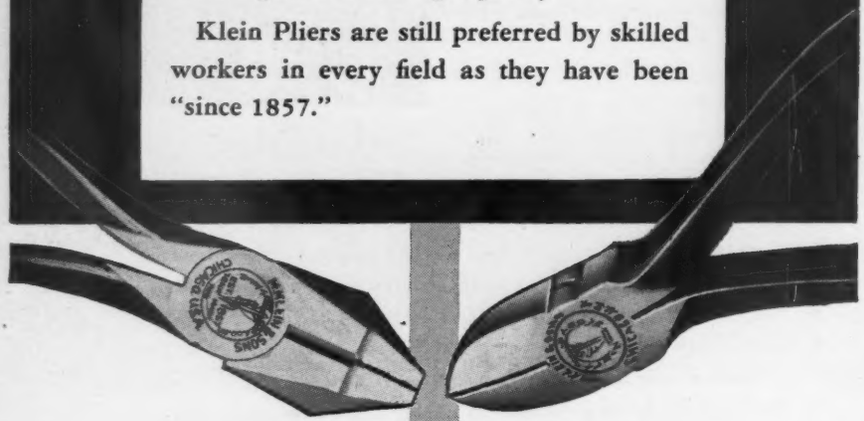
FOR MEN WHO WANT

the Best

• Ever since the first communication and power lines were strung, Klein Pliers have been the favorite tools of electrical workers.

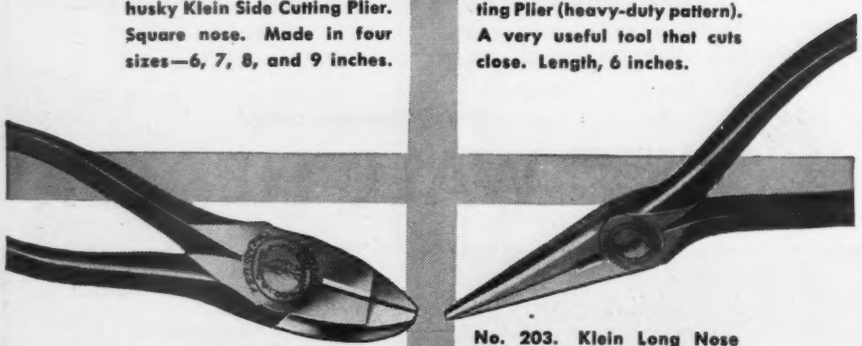
Today, Klein Pliers are made with the same exacting care that has won these tools their reputation for high quality.

Klein Pliers are still preferred by skilled workers in every field as they have been "since 1857."



No. 201. Original pattern husky Klein Side Cutting Plier. Square nose. Made in four sizes—6, 7, 8, and 9 inches.

No. 242. Klein Oblique Cutting Plier (heavy-duty pattern). A very useful tool that cuts close. Length, 6 inches.



No. 201 NE. The famous "streamlined" Klein Side Cutting Plier. Made in four sizes —6, 7, 8, and 9 inches.

No. 203. Klein Long Nose Plier. Long reach of jaws permits getting into difficult places. Made in 6 and 7-inch sizes.

The Klein Pocket Tool Guide, showing the Klein line and containing useful tool information, will be mailed on request.

Established 1857

Mathias KLEIN & Sons

Established 1857 — Chicago, Ill., U.S.A.

3200 BELMONT AVE. CHICAGO 18, ILL.

GB-3-21CFS **battery plug** used for starting oilfield pumping engines by Cannon Electric Development Co., Los Angeles, Calif. . . . . The "Quick-Strip" **wire stripper** is manufactured by Jaco Products Co., Cleveland, Ohio.

A plastic **diffusion shade** for fluorescent lights has been announced by Lee-Bert Inc., Saginaw, Mich. . . . International Register Company is manufacturing a new **timer** for radios, known as RC-1021. . . . The Wilton Tool Manufacturing Company, Chicago, is producing two improved **Power-arm units**, one mechanically operated for light work, and the other hydraulically operated for heavy duty work.

A new light weight, engine-driven, d-c-**welder**, designed for a wide range of general applications, has been announced by General Electric Co., Schenectady, N. Y. . . . Radio Frequency Corp., Boston, Mass., has brought a new **high frequency heater** for the controlled brazing, soldering and heat treating of metals. . . . A new liquid, known as **"Safe-T-Seal"**, is for moisture proofing electrical systems and is made by the Safety Distributing Co., Hollywood, Calif.

Precision Equipment Co., Chicago, Ill., has announced a new Fairchild ¼ inch **drill** and the Hi-Power ½ inch model. . . . General Electric Company, Schenectady, N. Y. has announced the extension of its line of **ballasts** for germicidal lamps. . . . A new, combination **emergency light** and signal flare, called Big Beam 400-F, has been introduced by the U-C Lite Manufacturing Company, Chicago, Ill.

A new tube cutter with free wheeling" ball bearing action has been announced by the Imperial Brass Mfg. Co., Chicago, Ill. . . . General Electric Company, Schenectady, N. Y. has developed a new **recording vibrometer** which measures and records frequency, displacement, and wave shape of mechanical vibration. . . . . A new **wire harness clamp**, which prevents short-circuits caused by abrasion, has been announced by Thomas Associates, Los Angeles, Calif.

The Pioneer Broach Company, Los Angeles, Calif. has put on the market a new chassis **punch**, which cuts square holes in sheet metal . . . A new plastic **diffuser strip** for fluorescent lights, is made by Extruders, Inc., Culver City, Calif. . . . The Adalet Manufacturing Co., Cleveland, Ohio, is manufacturing a new, low-priced **insulating bushing**.

A new automatic interval **timer** has been announced by General Electric Company, Schenectady, N. Y. . . . The Piqua Machine & Manufacturing Co., Piqua, Ohio has announced a new **centrifugal pump** for general sump and drainage work . . . . A new type spring battery **terminal** has been developed by James A. Stanley Co., New York City.

The Forest Electric Company, Forest Park, Ill. has developed new Falco luminous tube **transformers**. . . . An electric weld seals hydrogen gas under pressure in the metal case of the new mercury **switches** produced by Durakool, Inc., Elkhart, Ind.

Quik Quiz on CONDULETS

Questions and answers
regarding the backbone of an electrical wiring installation

Type C Obround Condulet
Broken-away view showing (1) tapered threads, and (2) the Wedgenut fastener

Question. When were CONDULETS first made?

Answer. In 1906 Crouse-Hinds Company introduced CONDULETS to the electrical wiring industry. CONDULETS represented an entirely new idea in conduit outlets, totally unlike the outlet boxes and fittings previously made. CONDULETS were destined to revolutionize electrical conduit installation practice.

Q. How did the word "CONDULET" originate?

A. Crouse-Hinds new conduit outlets needed a name so the word "CONDULET" was coined, a contraction of "conduit" and "outlet." It is registered in the U. S. Patent Office and designates a product made only by the Crouse-Hinds Company.

Q. What were the advantages of CONDULETS over previous outlets?

A. The older outlets were both unhandy and unsightly, while the new cast CONDULETS were streamlined, compact outlets that were handy to install and produced a neat appearing job. The oblong body with round ends suggested the name "Obround", which was applied to the first series of CONDULETS.

Q. Were they like the present Obround CONDULET?

A. There have been important refinements, but the basic design remains the same. The most notable improvement was the Crouse-Hinds Wedgenut fastener which provides a handy way to firmly attach the covers.

Q. How many types are now in the Obround Series?

A. Forty-nine types. Sizes to fit ⅛" to 6" conduits, with a wide selection of interchangeable covers and wiring devices.

Q. What other CONDULETS have been added to the line?

A. Obround CONDULETS were so well received by the electrical trade that a variety of other types followed in rapid succession. In fact, the CONDULET line has grown far beyond the original concept and now includes, besides the items needed for the usual conduit installations, a complete line of explosion-proof and dust-tight CONDULETS for use in industries where explosive gases or dust require special electrical safeguards.

Q. Why are all the threads in CONDULET hubs taper tapped?

A. Because all conduit threads are tapered and it makes an imperfect job if a tapered thread is screwed into a straight threaded hole. When using CONDULETS, the threads on the conduit firmly engage every thread in the hub, because both are tapered. This makes a rigid joint which will not loosen under vibration and also assures permanent ground continuity. Taper tapping is an important Crouse-Hinds feature.

Q. What about CONDULET quality?

A. CONDULETS have always been noted for the highest quality. They are scientifically designed in Crouse-Hinds Engineering Department and carefully manufactured in a modern factory by skilled craftsmen from the finest material obtainable. Crouse-Hinds operates four separate laboratories where trained technicians assist in the development of new products and maintain a constant control over the quality of CONDULETS.

Q. How many CONDULETS are there today?

A. More than 15,000 items constitute the present CONDULET line. Conduit installations in all parts of the world are equipped with CONDULETS.

Q. WHERE CAN I BUY CONDULETS?

A. From the beginning it has been the Crouse-Hinds policy to have . . . **A Nationwide Distribution through Electrical Wholesalers.** There is one near you.

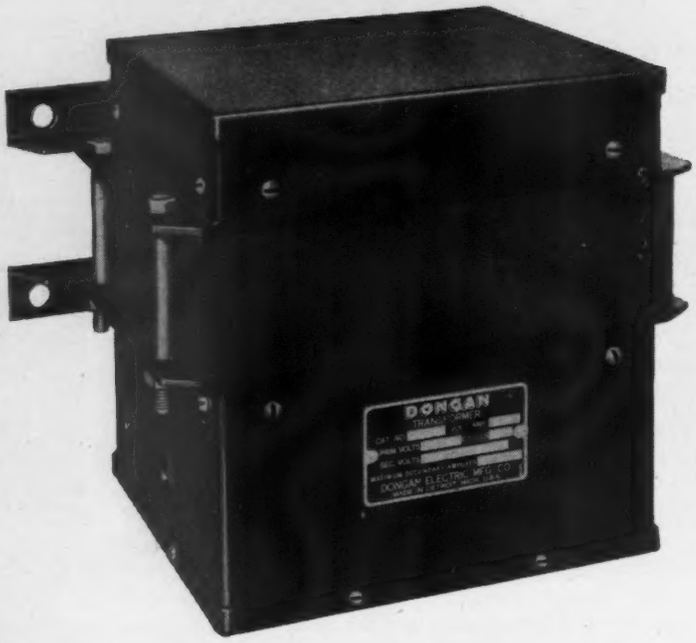
CONDULETS
FLOODLIGHTS
TRAFFIC SIGNALS
AIRPORT LIGHTING

CROUSE-HINDS COMPANY
Syracuse 1, N. Y.

Offices: Birmingham — Boston — Buffalo — Chicago — Cincinnati — Cleveland — Dallas — Denver — Detroit Houston — Indianapolis — Kansas City — Los Angeles — Milwaukee — Minneapolis — New York Philadelphia — Pittsburgh — Portland, Ore. — San Francisco — Seattle — St. Louis — Washington.
Resident Representatives: Albany — Atlanta — Baltimore — Charlotte — New Orleans — Richmond, Va.
CROUSE-HINDS COMPANY OF CANADA, LTD., *Main Office and Plant.* TORONTO, ONT.

A Nationwide Distribution Through Electrical Wholesalers

Immediate Delivery
FROM STOCK



Power Circuit Transformers

for Lighting and Operating Machine Tools

ESPECIALLY designed for use on circuits of 600 volts or less. Sizes: 50 V.A. to 37½ K.V.A. Primary and secondary are in separate compartments, eliminating the necessity of additional wiring boxes.

• ***Write for New Catalog*** •

DONGAN ELECTRIC MFG. CO.

2980 Franklin **Detroit 7, Mich.**

The Dongan Line Since Nineteen-Nine

DONGAN TRANSFORMERS

CHECK AND DOUBLE CHECK

[FROM PAGE 57]

percentages to material — with the Labor adder being about the same.

In an effort to arrive at a starting point as to what an hourly labor-burden should be, let's consider the NECA Report of 1937 and establish a set of average conditions. An average of nine businesses indicated an overhead to Labor Cost ratio of 0.62 or 62 percent.

If the labor rate paid for these nine businesses was $1.00 per hour, then the burden would be 62 cents per hour. However, it is more reasonable to assume that the average wage paid in 1937 for these businesses was $1.50 per hour, in which case the burden would be 93 cents per hour.

The procedure outlined herewith applies to any electrical installation business, large or small, specialized or unspecialized, motor shop, repair business, or others, *but it is predicated upon attaining a certain volume of sales with certain personnel and facilities.*

Labor only contracts can be performed with absolute assurance that costs are covered.

Large material and equipment sales can be made with full assurance of adequate profit under competitive conditions.

What about the over-all Return? Figure 4 shows a curve which is recommended for jobs of various sizes. Bear in mind when studying this curve that one of the biggest factors is still in contingency—upon accurate labor estimating, quality of labor, and duration of the job.

Figure 5 shows how the monthly profit and loss statement ties into the Burden Control. The average Burden Rate is carried forward from month to month and the actual Overhead Dollars absorbed in estimates are constantly observed.

Businesses can be run successfully if you as an operator—

1—Know the facts about material take off and labor estimating.

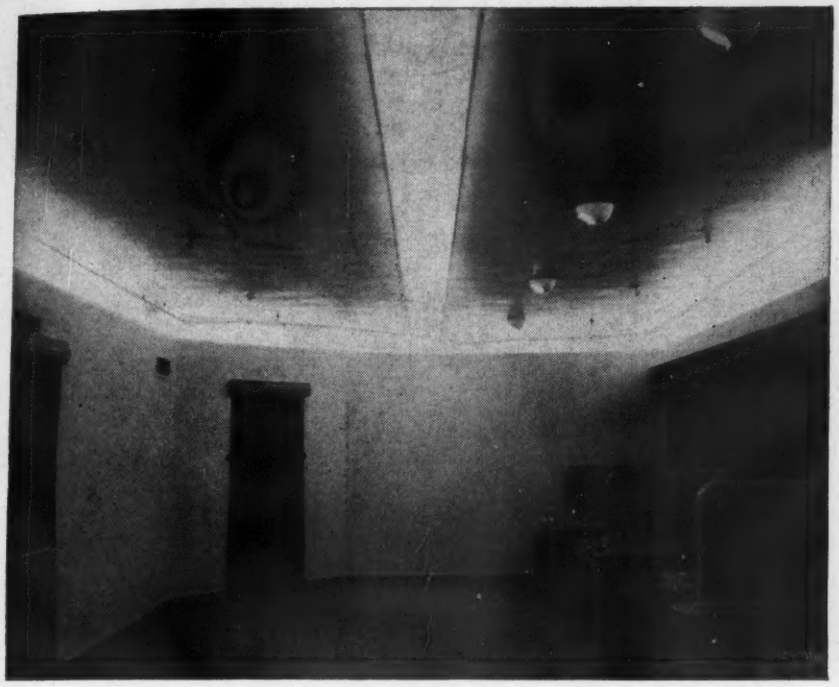
2—Know your operating costs, and buy right.

3—Know your business conditions and work hard to attain volumes of anticipated sales.

4—Have the courage to add an adequate Return.

All the undesirable features of previous procedures seem to be satisfied by the method outlined above, and a means is provided for any business of any size to function successfully under its administration.

Modern Lighting



Slimline fluorescent lamps provide general lighting and recessed adjustable R-40 Spots provide accent lighting in Mandelbaum Coats, Inc., salesroom, New York City.

Lighting a Women's Coat Salon

In the sales room of Mandelbaum Coats, New York City, fluorescent lighting provides general illumination throughout the salon, while individual incandescent spots are used to highlight the coats which are exhibited individually on live models.

Reported to be the first all-Slimline fluorescent lighting installation made in New York City, general lighting is provided by one continuous row semi-recessed unit in the center of the ceiling, and a continuous cove around the perimeter of the room. The center ceiling unit is 38 feet 3 inches long by 13 inches wide, and contains four rows of Slimline lamps concealed above molded lens glass panels which shield the lamps and diffuse the light. The cove lighting consists of two continuous rows of Slimline lamps installed on a wiring channel which also serves as a reflector. Lamps in each row are installed staggered so that lamp housings do not occur at the same point. This eliminates the possibility of pronounced shadows along the line of the cove.

Five individual recessed adjustable spots are also installed in the ceiling, on eight foot centers, and about five feet from the rear, or window wall. These units each use a 300 watt R-40 spotlight lamp, and are directed toward the center of the room.

Buyers who visit the salon are each assigned to an individual salesman. The buyer and the salesman then seat themselves in one of the five booths along the window wall. The salesman then proceeds to have coats displayed on the live models, who stand in front of the booth and near the center of the room. This location places the model in the beam light from the recessed spot overhead, with the light striking the model from above at an angle of about 30 degrees from the vertical. The high intensity general illumination, supplemented by the beam of light from the incandescent spot, makes it easy for the buyer and salesman to observe style, color, fabric and other details of the merchandise easily from their location in the sales booths.

This lighting layout and all equipment were furnished by Gruber Brothers, Inc., New York City.

Bank Installs Planned Lighting

Planned Lighting can be sold most successfully when all segments of the lighting industry get together and cooperate fully. An outstanding example of such cooperation was demonstrated recently in the relighting of the Beneficial Saving Fund Society's South Philadelphia office, Philadelphia, Pa. Among those collaborating in the planning of the lighting for this bank were the owners, the electric utility, the lighting equipment manufacturer, the architect and the electrical contractor. As a result of the collaboration of these individuals, an unusually good lighting job was installed.

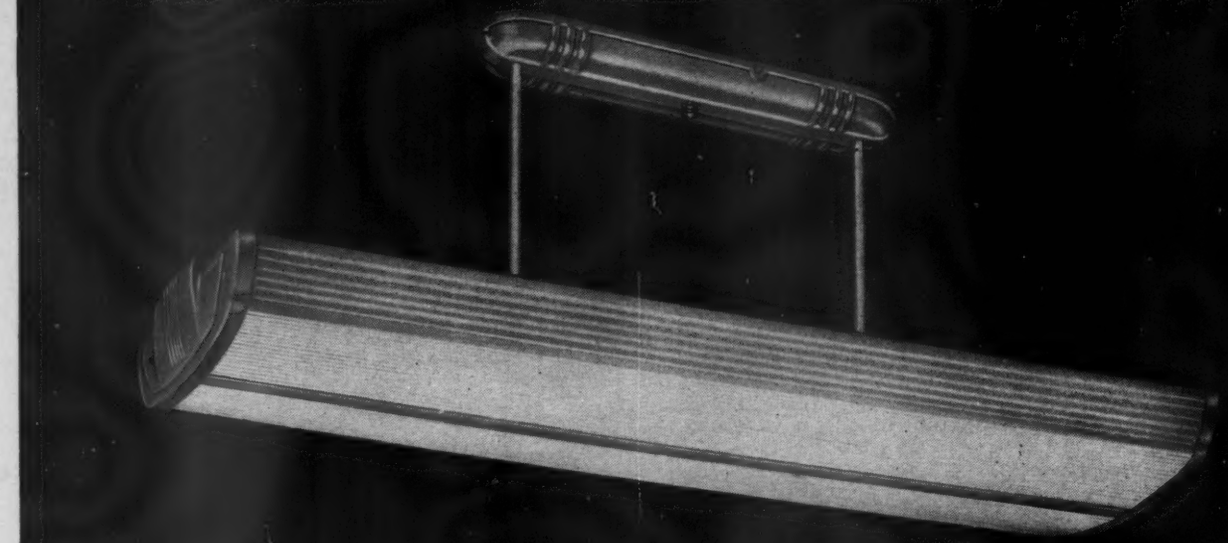
The old lighting job consisted of old style chandeliers equipped with bare lamps which were suspended on long chains. These caused glare and severe contrast in brightness ratios. Cashiers and tellers were closed in behind high partitions of glass and wood, making seeing even more difficult, and resulted in a gloomy and unattractive atmosphere.

After careful study of the bank interior, a *Planned Lighting* layout was prepared. This layout included not only the lighting equipment and lamps, but also was supplemented by needed improvements in wall and ceiling surfaces, changes in furniture, and replacement of venetian blinds with drapes, and by expertly engineered wiring and control equipment. The accompanying photo showing the bank interior after the modernization was completed in accordance with the plan, illustrates the value of collaboration of experienced lighting men with the owner and architect.

The lighting equipment used consists of ten Holophane recessed units, each equipped with a 300-watt lamp, to light the balcony office area (rear of bank), and a custom-built continuous row surface mounted unit in the center of the arched ceiling to light the main banking area. The continuous row unit is 112 ft. 6 in. long, 28 in. wide, and 13 in. deep. Designed and made by Allied Crafts Company, it contains 60 Holophane Controlens units, each equipped with a 300-watt lamp. Spacers are pyramidal glass and side panels are white alabaster glass. Fifteen circuits provide current to this unit, which is wired with alternate units on

Lighter weight-Lighter work...

THE NEW "CD SERIES" LUMINAIRES



FOR EASY HANDLING • QUICK INSTALLATION

SIMPLE MAINTENANCE

YOU CAN BE SURE ...
IF IT'S
Westinghouse

Westinghouse
PLANTS IN 25 CITIES... OFFICES EVERYWHERE

Never before have we announced a new fixture with such outstanding maintenance and installation advantages as the new Type CD-160 unit for schools and offices. It's a companion unit of the familiar CD-80.

The CD units have specific design and economic advantages for the contractor and maintenance superintendent.

1. Lightweight plastic makes handling easier, safer—speeds installation.
2. Lamps and starters replaced from the top without removing panels or louvers.
3. Units may be suspension, or close-to-ceiling, mounted; individually or in continuous rows.
4. Plastic and louver bottom panels are interchangeable.
5. Cleaning is easy—panels can be quickly removed and replaced.
6. The CD-160 (four 40-watt lamps) or the companion CD-80 (two 40-watt lamps) is ideal for any classroom or office layout.

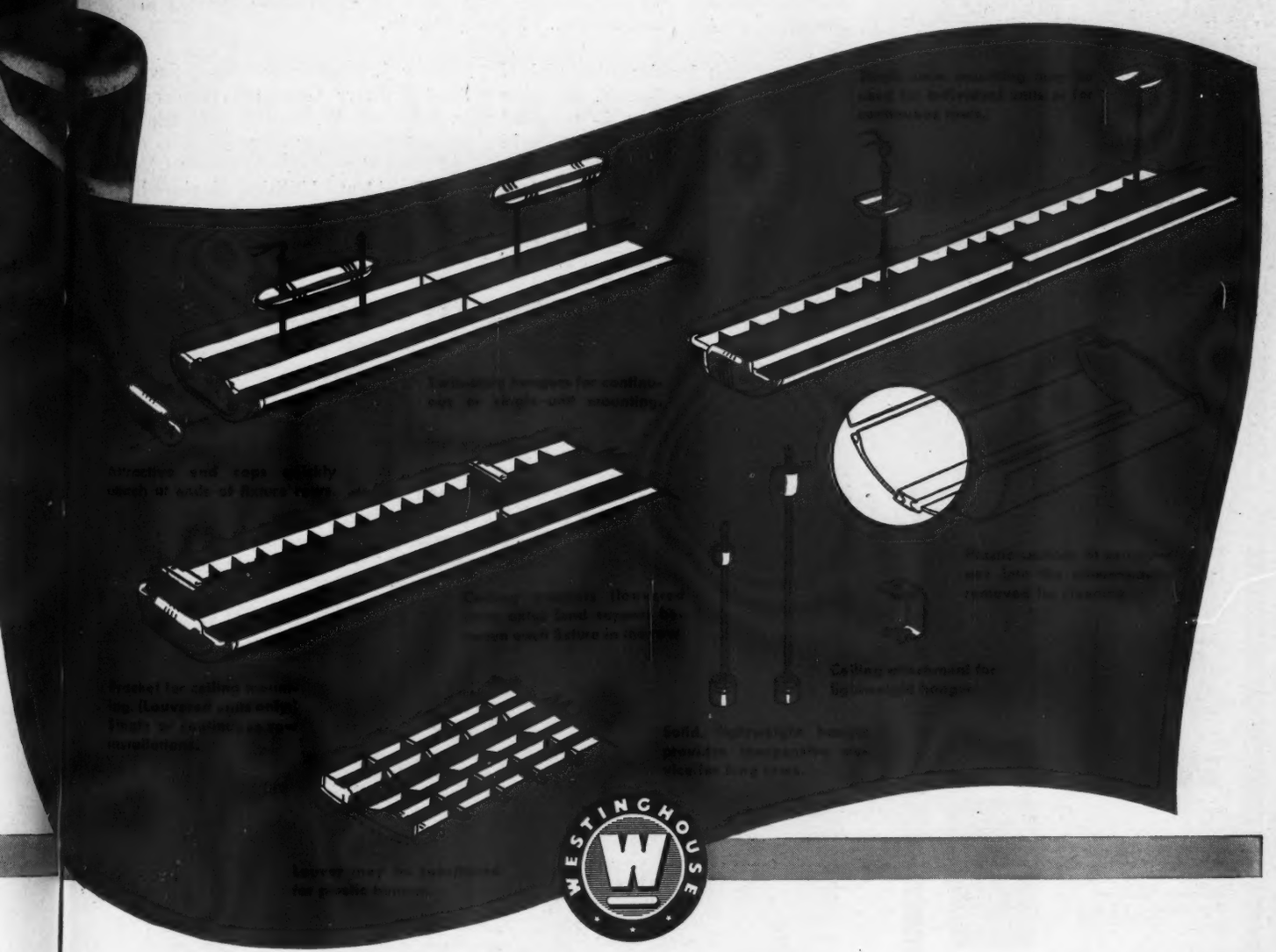
The CD-80 and CD-160 units are designed for efficient, economical illumination in schools and offices. They're safe, and easy to install . . . they're efficient in light distribution . . . and they're simple to maintain.

Call your Westinghouse Distributor today. A Westinghouse Lighting Engineer will gladly co-operate with you and your local Power Company in planning schoolroom or office layouts.

New "CD Series" Booklet Now Available

Write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa., for B-4075, "Type CD Series Fluorescent Luminaires".

J-04199



Planned Lighting *Pays*

COMMERCIAL • INDUSTRIAL • FLOOD • STREET • AVIATION

DEPENDABLE
"Old timer"
Paragon
ESTABLISHED 1905

300 Series
LIST FROM
$14.00

TIME CONTROL
SWITCHES

For better construction and easier maintenance of your installations, depend on timers ... Paragon Engineered ... Underwriters Approved ... Telechron Motored. The 300 Series shown above are popular for Stokers, Oil Burners, Pumps, Valves, Window and Sign Lighting.

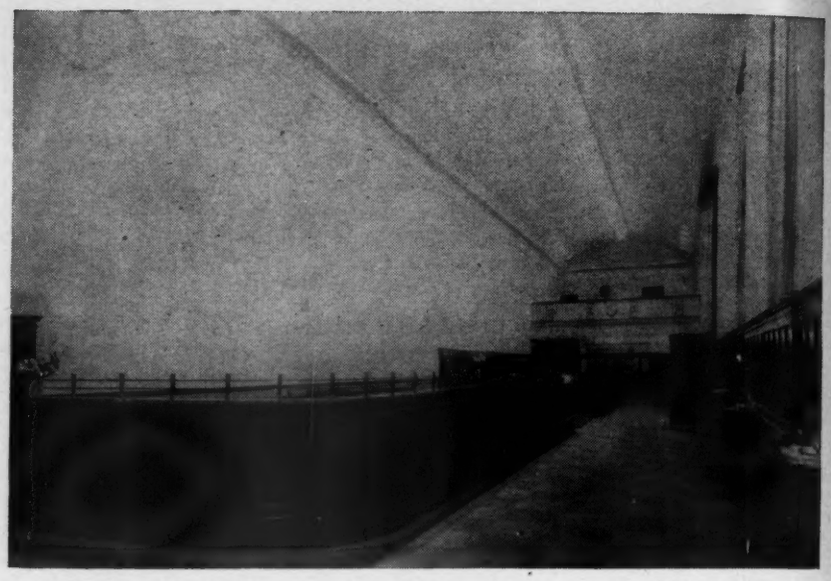
ASK YOUR JOBBER

700 Series. 7 day Dial Time Switches. Setting for each day in week. For Heating ... Ventilating ... Air Conditioning. From $32.50 List.

PS-30 Series. Poultry Time Switches for permanent installations. Provision for Bright and Dim circuits. $13.50 List.

LIBERAL TRADE DISCOUNTS

PARAGON ELECTRIC COMPANY
1614 TWELFTH ST.
TWO RIVERS, WISCONSIN



Modern Planned Lighting provides high level of comfortable lighting in Beneficial Saving Fund Society, Philadelphia, Pa.

the same circuit for operation of half or all of the units as desired. Lighting for the tellers' counters is provided by a concealed strip of 40-watt T-12 white fluorescent lamps.

Those cooperating in the design of this modern *Planned Lighting* system included: Francis P. Burns, Executive Vice-President, Ambrose Fay and Andrew J. Keegan, Beneficial Saving Fund Society; George T. Anderson, Jr. and James W. Heaton, Philadelphia Electric Company; Bert Wright, Allied Craft Company, and Howard Miller, President, Utilities Engineering Company, electrical contractors who performed the electrical construction and installation work.

Functional Lighting For Merchandising

Chapman's, located in Saginaw, Michigan, has an attractive functional lighting system that harmonizes with the general design of the store, and provides a pleasing combination of fluorescent and incandescent lighting for displaying merchandise. The store, measuring 68 by 58 feet with a 9-foot 6-inch ceiling is lighted by recessed lighting units on 8-foot centers. Fluorescent fixtures are 3-lamp 40-watt units while incandescent units are 150-watt PAR-38 Hy-Liters. After 2700 hours of service, readings taken 34 inches above the floor showed averages of 53 footcandles in the center of the room directly beneath the luminous rows, and 49 footcandles half way between the rows. All lighting units were manufactured by the Edwin F. Guth Company and the lighting plan was designed by Earl Domoney, lighting engineer for the Consumer Power Company in Saginaw.

Combination of recessed 3-lamp fluorescent troffers and 150-watt PAR-38 adjustable incandescent units provide average intensities above 50 fcs.

No Need to Clip Pigtails!

with this Amazing New

BLACKBURN *Building Wire* CONNECTOR

This efficient new BLACKBURN Connector is ideal for motor leads and junction boxes, because connections may be changed without clipping off the old pigtails. You simply remove the connector and rearrange the wires.

The BLACKBURN Building Wire Connector costs as little as 5c. It's an efficient, tried-and-proved connector for any inside use. Three sizes cover a range from #14 to #4. Self-contained washer prevents set screw from cutting into wires.

This new connector is easy and quick to install, and easy to remove for re-connections or wire changes. It's small, compact, and easy to tape. Economical too—because it saves the labor of soldering.

SEND FOR FREE SAMPLES, OR ORDER FROM YOUR JOBBER, TODAY

Catalog Number	Wire Sizes Minimum	Wire Sizes Maximum	Standard Package	Shipping Weight per 100
10 U	2 #14	4 #14 3 #12 2 #10	100	1 lb.
6 U	2 #8	3 #8 2 #6	100	2 lbs.
4 U	2 #6	2 #4	100	3 lbs.

Costs as little as 5¢!

FULLY APPROVED BY UNDERWRITERS' LABORATORIES!

Many Uses:

In Junction Boxes
For Connecting Motor Leads
For Connecting Light Fixtures
For Connecting Electric Ranges
For Any Indoor Wiring

3 Sizes Cover Range From #14 to #4

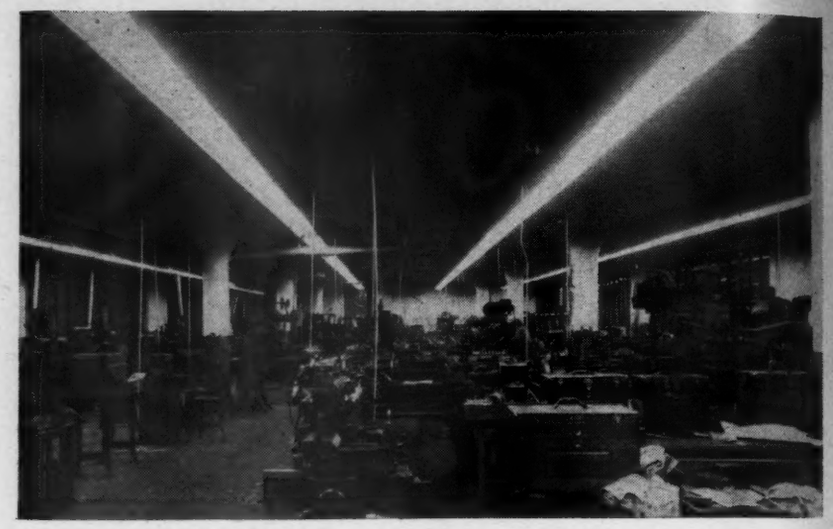
FIRST, MADISON & CLINTON STS. • **JASPER BLACKBURN PRODUCTS CORP.** • ST. LOUIS 6, MISSOURI

BUILDERS OF QUALITY PRODUCTS FOR 15 YEARS

ROYAL

ROYAL FUSES

ROYAL ELECTRIC CO., Inc.
PAWTUCKET, RHODE ISLAND



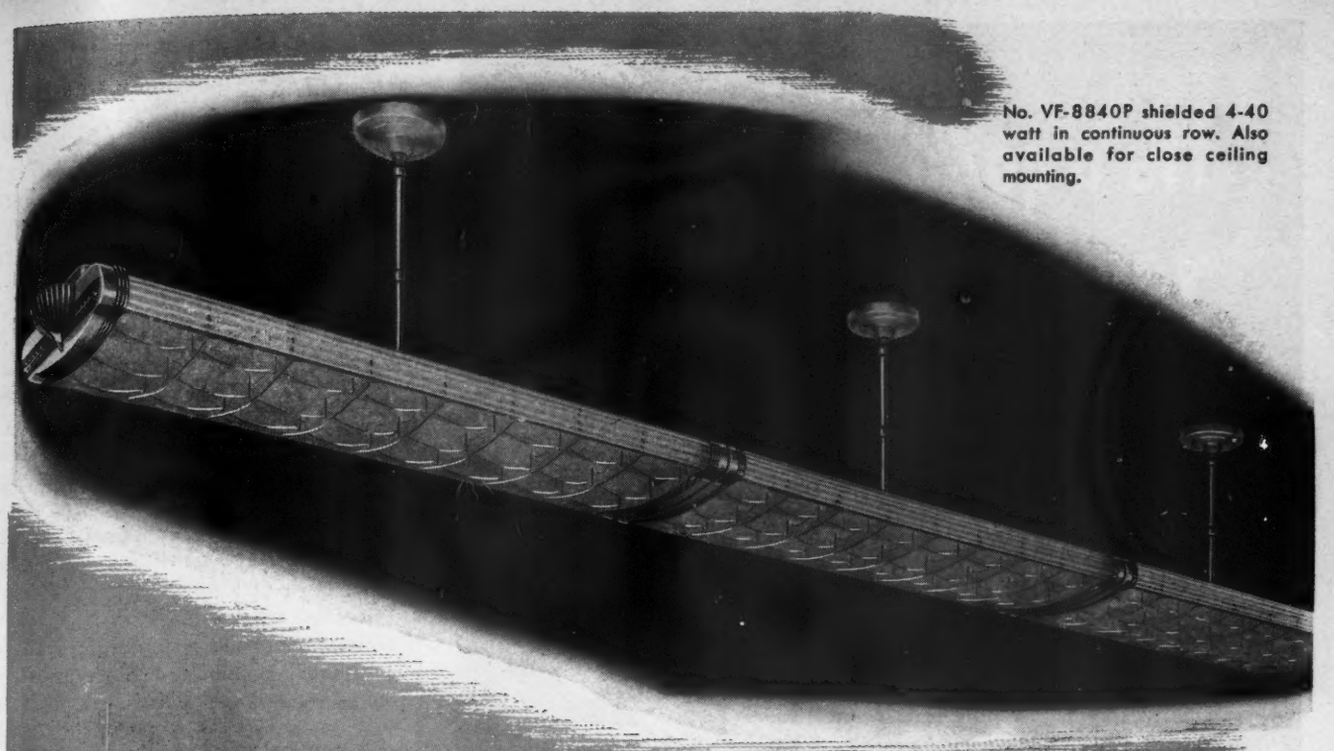
Average of 45 footcandles at working levels is achieved by installation of 95 two-lamp industrial fluorescent fixtures mounted on 11.5-foot centers.

Continuous Fluorescents For Shop Lighting

In an active machine shop, where insufficient illumination on the working areas may result in delays, spoilage or accident, an investment in good lighting represents practical insurance for both efficiency and safety. This thinking is evident in the shop areas of the Arthur A. Crafts Co., Boston, Mass., manufacturers of diamond drills.

The lighting installation, designed by lighting consultants of the Boston Edison Company, delivers an average of 45 footcandles to table and machine levels and employs 95 fluorescent fixtures to light a 9700-square-foot area. Two-lamp 40-watt 4-foot industrial fixtures are selected, mounted on 11.5-foot centers in four rows running the length of the shop. With an 11-foot ceiling, three rows are mounted at heights of 10 feet, the fourth row being suspended a foot lower due to pipe racks and other obstructions in this section of the manufacturing space. With a connected lighting load of 9500 watts, the resultant consumption figures slightly less than 1 watt per square foot.

Average intensities above 75 footcandles are achieved in the Thames Rexall Drug Store in Beaumont, Texas, by 31 Mitchell Slimline fixtures, each using four 8-foot lamps operating at 200 ma. Mounted on 12-foot centers, each unit illuminates approximately 100 square feet and has a Coefficient of Utilization of 57 percent. Lighting plans were prepared by Clarence Brown, Gulf States Utilities Company.



No. VF-8840P shielded 4-40 watt in continuous row. Also available for close ceiling mounting.

COMMERCIAL FLUORESCENT *by Virden*

for Continuous Lines of Light

you'll like this fluorescent unit by Virden. Smart style. Crisp, clean lines. Pleasing use of modern plastics. Outstanding performance. High efficiency. Easy to install. Priced for extra value . . . thanks to Virden skill in mass production. Supplied exclusively through your Virden jobber. Let his friendly service help you.

Smooth soft light well distributed for planned lighting . . . by Virden.

See how long lines of fluorescent by Virden can provide a ceiling of light.

VIRDEN VALUE

John C. Virden Company • Cleveland, Ohio

Member American Home Lighting Institute

It's a good plan for you to put these three planks in your planned lighting platform
1. Champion Fluorescent and Incandescent Lamp Quality. When you standardize on lamps bearing the Champion diamond mark you can be certain of the best light for your money. Champion Lamps are guaranteed to equal or exceed Federal Specifications — backed by one of the oldest and largest manufacturers in the business.
2. Champion Industrial Lighting Service — trained experts in the field to give you unbiased recommendations on lighting and lamp applications to meet your individual requirements.
3. Champion Industrial Distribution—Champion Lamps are available in your locality through electrical or industrial supply houses that know your needs and are qualified to give you prompt, intelligent, low cost service. There's no better, more efficient or more economical way to buy lamps.
MAINTENANCE MANUAL
CHAMPION
Let us mail you a copy of the Champion Maintenance Manual A. It's full of useful hints on how to make the most of planned lighting.
CHAMPION LAMP WORKS
Lynn, Massachusetts
DIVISION OF CONSOLIDATED ELECTRIC LAMP CO

LOUVERALL LIGHTING SYSTEMS

[FROM PAGE 64]

pearance of the finished installation, and also to afford ample room for maintenance of the lighting equipment; but yet small enough that the louver sections themselves could be easily handled and maintained.

It can be readily seen that a distribution curve of a 3 ft. by 5 ft. panel of louverall ceiling is not adequate for making illumination measurements, since the light from reflectors installed over other panels would augment the light over any specific panel. But comparative illumination data was needed between plastic Vinylite louvers and other types of louvers. After full consideration of this problem, it was decided to set up a test room representing a typical small office, and to use the entire room area for each test on each type of louver. This test room was set up in the laboratory of the Benjamin Electric Mfg. Company.

The test room selected was 15 ft. 6 in. square, with a 14 ft. 6 in. high ceiling. Open end porcelain enamel steel reflector units, each using three 40-watt 4500 degree white fluorescent lamps were installed 18 inches above the top side of louvers when put in place, and on 3 ft. by 5 ft. centers. A steel supporting framework with openings for fifteen 3 ft. by 5 ft. louver sections was suspended from the ceiling so that the bottom of the louvers would be 9 ft. 2 in. from the floor.

The test was conducted by making footcandle measurements both vertical and horizontal, under laboratory conditions with a color and cosine corrected calibrated cell. One set of readings was made using no louvers. Other sets of readings were then made with louvers of five different types of materials. Readings made when using no louvers, that is, with the reflectors only without a louverall ceiling, were termed 100 percent, and all subsequent readings made with louvers installed were related to the readings using no louvers. These data thus permit direct comparison of footcandles, in "Percent Footcandles in Terms of No Louvers".

Other data obtained included brightness of louvers when lighted, reflection factor of louvers, and transmission factor for the plastic Vinylite louvers. In addition, the coefficient of utilization was computed for each louver system. The results of this test are shown in the "Illumination Data on Louverall Lighting" table.

Industrial Electrification

ENGINEERING • INSTALLATION • MAINTENANCE

Selection and Application of V-Belt Drives—I

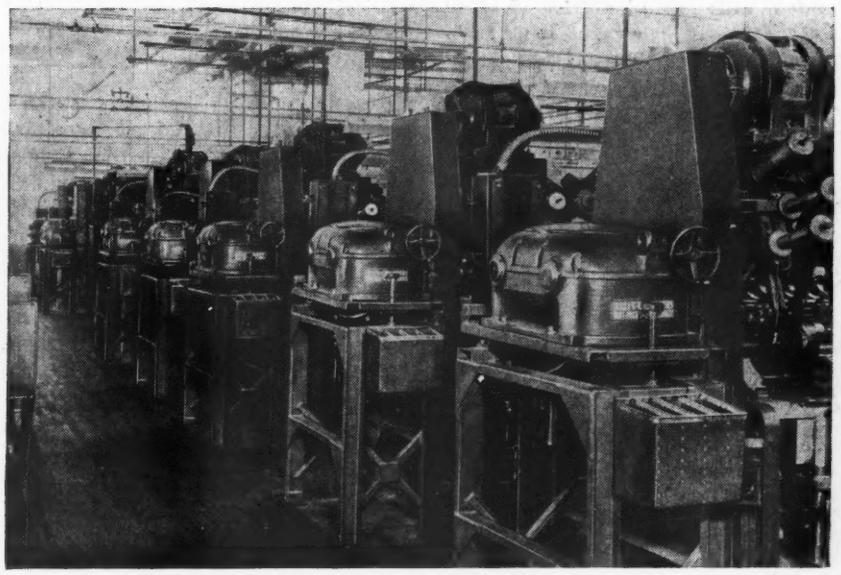
V-Belt Drive operating principles, advantages, types and maintenance hints are discussed in this first of two articles.

By C. J. Busacca and F. H. Rumble
Texrope Department
Allis-Chalmers Manufacturing Co.
Milwaukee, Wisconsin

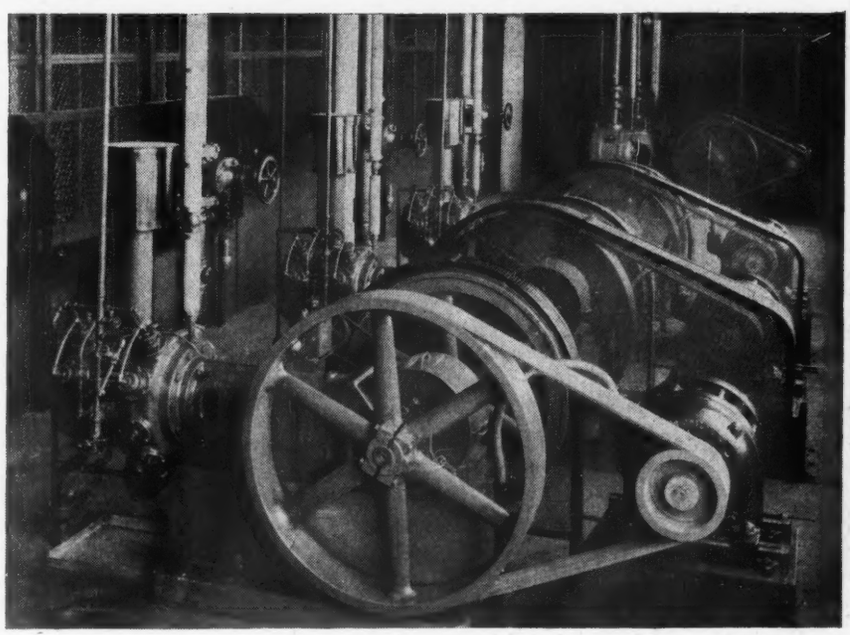
THE familiar V-belt power transmission device is so common and so simple in appearance that many users are inclined to take it too much for granted. They fail to realize that it requires the application of sound engineering principles in selection and installation, and commonsense operating procedures, just as do the more complicated power transmission devices. Because a V-belt is comparatively simple, the rules for proper selection, installation, and operation are also simple, but important in obtaining maximum efficiency, long belt life, and minimum initial and replacement costs.

A V-belt drive consists of a driving and a driven sheave, both grooved for use with one or more endless belts of trapezoidal cross-section. *Power is transmitted by the wedging contact between the sides of the V-belt and the sides of the groove walls.* In a properly constructed drive, the belts do not touch the bottom of the grooves. When a V-belt is flexed, it bulges at the sides but, when turning a sheave, this normal effort to bulge is confined by the rigid V-shaped grooves of the sheave. Such confinement within the grooves produces a high pressure contact between belt and groove wall which effects a vise-like grip and dependable, non-slip operation. Whereas a flat belt depends on tight frictional contact for its grip, a chain drive on sprockets, and a gear drive on teeth—a V-belt produces its own grip.

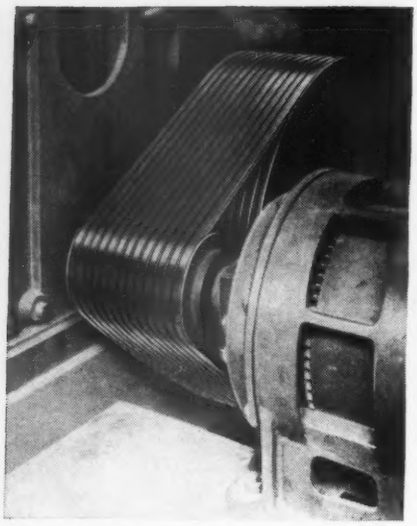
This principle of grip explains why V-belts require less tension than, for instance, the flat belt drive. Only when



V-belts with variable pitch sheaves (in speed-changer units) permit changing speed of these textile machines while running.

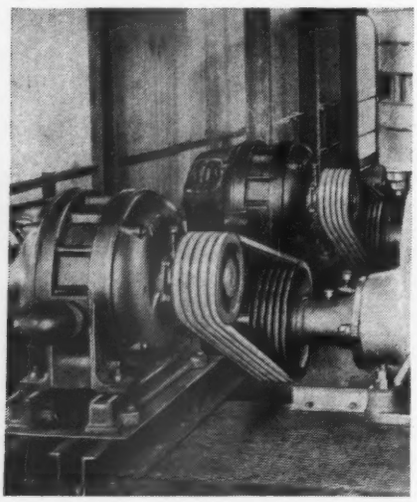


A compact V-belt compressor drive with a cast-iron driven sheave.

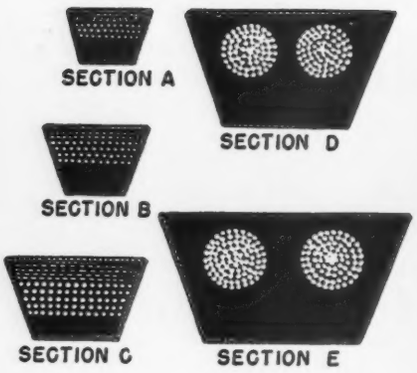


A paper mill rewinder drive showing extremely short center and large ratio possible with V-belt drives.

Three set screws lock this tapered split bushing sheave securely to driven shaft.



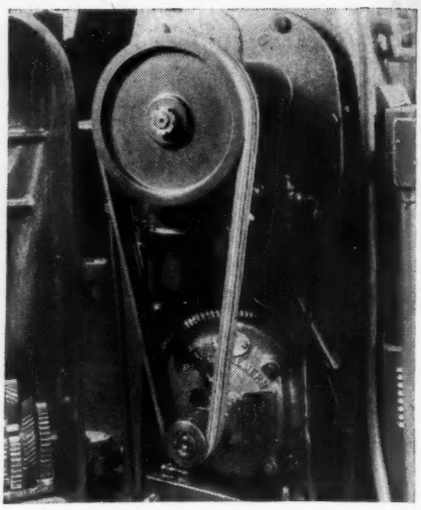
Sliding bases on these motors permit belt tension adjustment on this crusher drive.



Strong laminated construction is used for section A, B and C v-belts.

Twin cable cord construction is used to advantage in heavy duty D and E section belts.

Typical sections of standard size V-belts.



Motors can be mounted as an integral part of machine tools when V-belt drives are used.

too little tension is applied is there possibility for slip and a breakdown of the belt's gripping principles. Proper tension will never over-load motor bearings. Although a V-belt does not depend on tension to provide its grip, it is dependent on tension for the *extent* of its grip. *Inadequate tension allows a V-belt to sag and thereby reduce the arc of contact.* Inasmuch as horsepower ratings for V-belts are based on an arc of 180 degrees, the importance of maintaining this arc of contact is easily discernible.

When engineering and installing a drive, it is well to remember that proper tension and proper contact must be maintained to have the drive deliver its rated horsepower. As most plants do not have facilities for measuring tension in terms of pounds pull, this simple rule can be followed:

A slack V-belt feels dead when you thump it with your hand; a properly taut V-belt has an alive springiness.

One-half of one percent stretch is not harmful to rubber V-belts. In fact, it is good for them for it assures operation under proper tension. Here is a method sometimes used to approximate the correct tension when a drive is first installed. After the belts have been placed in position and "run in" for a short time, back up the motor sufficiently to take all sag out of the belts. From this point move the motor back approximately one-fourth of one percent of the pitch length of the belt. This will produce about one-half of one percent stretch in the total length of the belt. The resultant tension should be maintained by periodic checks.

Proper tension prevents slippage which burns the belt sides; also prevents "crack the whip" action, or "snubbing", which may snap a V-belt. This snapping is most likely to occur when a motor is first started, or at peak loads when the extra slack is suddenly taken up and the last section of belt to be whipped taut jerks with a greater force than it was designed to withstand.

Advantages of V-Belt Drives

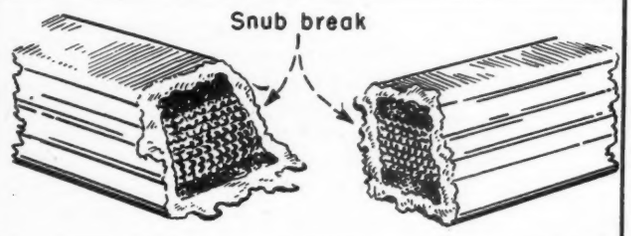
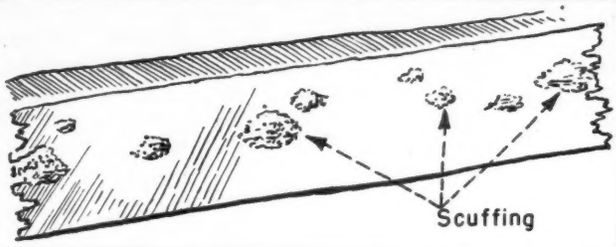
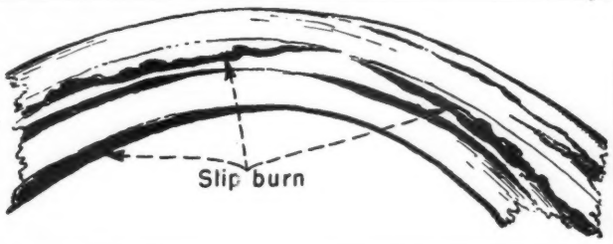
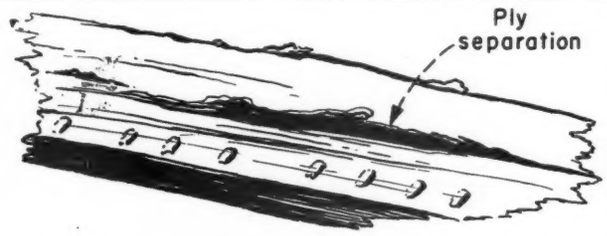
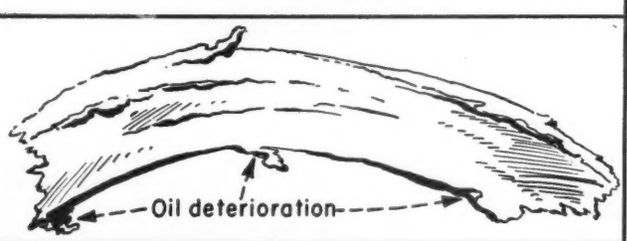
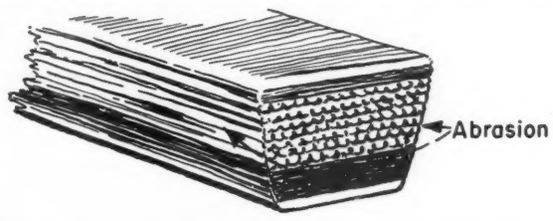
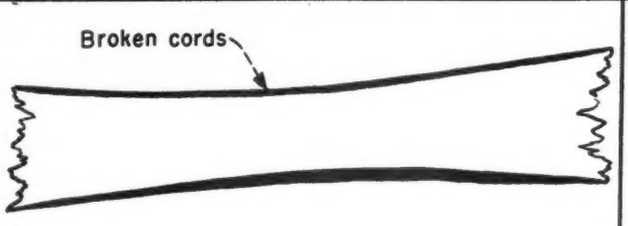
Since V-belts are usually used in multiple, even though one or more belts fail, the drive will generally operate with the remaining belts until it is convenient to make replacements. This provides an added measure of operating dependability.

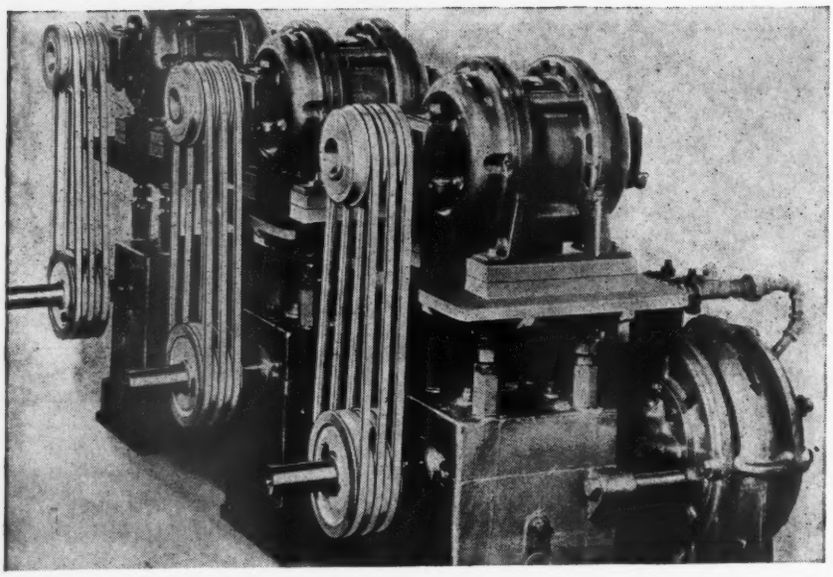
Another important V-belt feature is the ability to operate on unusually short centers and large ratios. Centers may be as short as sheave diameters will allow; and ratios may run from 1 to 1 up to 7 to 1 or over. Also, center lines may be inclined at any angle and the drive may be started, accelerated, stopped and reversed as readily as the motor itself without injury to the belt.

Because V-belts are endless belts of rubber and fabric, there is no slipping, humming, or clicking to annoy workers. Even after lengthy service the drive remains vibration free and silent.

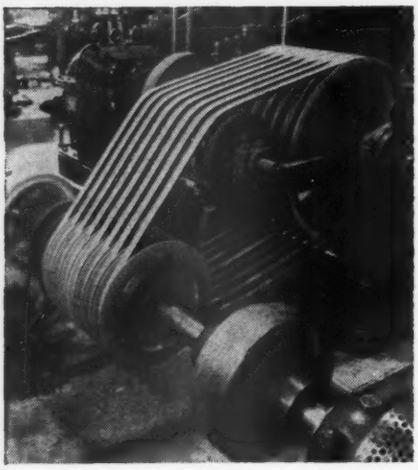
The V-belt is the easiest, quickest, and most economical drive to install. Such drives can be run in either direction with the slack on top or bottom. Sheaves are easily mounted on shafts, and the large ratios permissible make standard, high-speed, low-cost motors practicable. These drives are clean; need no lubrication or belt dressing; will not spatter oil, grease, or wax. Machines, walls and floors will remain clean.

BELT WEAR CHECK CHART

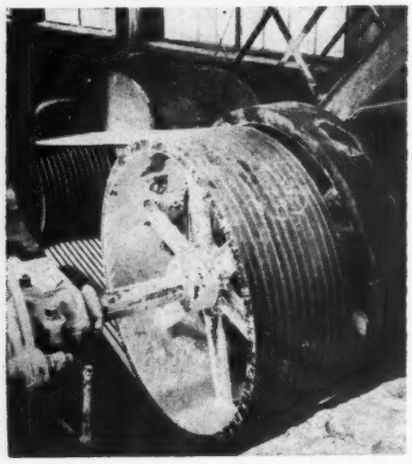
INJURY	CAUSE	PREVENTION
	Two signs show this broken V-belt to be the victim of crack-the-whip: (1) cover wear indicates considerable slip; (2) the fairly clean break suggests a sudden snap. Evidently the belt was slipping, suddenly grabbed	Keeping V-belts properly taut should be a regular, routine procedure. Test for excessive slack. Or test for slip by comparing speed ratio of sheaves between no load and full load. Allow able variation: one half of one percent.
	Bolts protruding inside the guard did the damage here. Such scuffing can exert enough "braking" to cause a sudden snap, which happened to this belt.	When placing guards or steelwork near drives, some stretch and sag should be anticipated. Leave enough clearance so V-belts can sag a bit without disastrous results.
	Belt too loose to pull its load. While belt stood motionless, frictional contact with spinning driving sheave melted its rubber. When the belt finally did grab, it snapped.	See first item, above. Of course, the load may have been too great. If tension in the drive is proper and sheave grooves and V-belts are free of oil or grease yet slip persists—check machine for increase in load.
	Split along pitch line indicates V-belt was run over too-small sheave. Excessive bending produced excessive internal friction, baking the life out of the rubber binder which holds the pulling cords together.	With every V-belt size goes a minimum sheave diameter. Any saving in sheave cost by ignoring manufacturers' recommendations is more than paid for in more frequent V-belt replacements.
	V-belt drove threading machine which employed cutting oil. After only one year of operation, oil had rendered rubber soft and lifeless — no longer of support to cord and fabric.	Splash guards will provide some protection against oils or greases. But where considerable oil reaches V-belts, special oil-resisting V-belts of synthetic rubber may be the best answer.
	Abrasive dust wore the sidewalls, narrowing belt width. Belt then rode on bottom of groove, slipped, lost its proper shape as well as its size.	When V-belt drives are located in dusty surroundings, dust guards will provide important protection. Because slip contributes to abrasive action, proper tension is ***doubly*** vital in dusty places!
	Inner cords were broken when belt was pried over sheave flange on installation. (Cover, being bias-cut fabric, stretches without breaking). Such breaks can be caused also by pieces of wood or metal falling into groove.	Never pry new belts into grooves,—nor "ring" them from one groove to next. Motor should be loosened and moved forward. ***Every drive should have a takeup for proper installation of new V-belts and adjustment of tension***



Variable capacity of these centrifugal pumps is obtained through use of adjustable speed V-belt drives.



Idler sheave arrangement maintains proper belt tension where movable bases are not practical.



A crusher drive that takes plenty of punishment under adverse operating conditions.

Machines using V-belt drives are self-contained units. As the drives are flexible and use short centers, the motor of the driven machine can be conveniently located on the machine, or the machine itself can be more conveniently located in the plant.

To obtain speed changes on any type of machinery using V-belt drives, it is generally necessary to change only one sheave of the drive or to use variable pitch sheaves which are available from some manufacturers and dealers.

These numerous advantages of V-belt drives are available only when the drives are properly installed and correct belt tension maintained.

The constant speed, V-to-V, drive is most frequently used. This type of drive utilizes two single or multi-grooved sheaves (the driver and the driven sheave) and the proper number of power transmitting V-belts. It is used whenever a fixed speed ratio or specific driven rpm. is desired.

Variable speed drives are V-belt drives having one or both sheaves arranged to permit axial movement of the groove walls, thereby causing the belt to ride higher or lower as the groove is narrowed or widened. *A change in groove width effects a change in the pitch diameter and thus, in the speed.* Adjustment is accomplished by releasing the belt tension, turning the adjusting nut to the desired pitch diameter and then restoring proper belt tension. This changing of pitch diameters effects an increase or decrease in the speed of the driven shaft, the range of increase or decrease being decided by the requirements of the job. Some types of variable pitch diameter sheaves have arrangements whereby the speed can be varied while the drive is in motion.

V-flat drives are similar to V to V drives but utilize a flat pulley or flywheel in place of a grooved, driven sheave. In this case, the V-belts run on the flat surface of the large pulley. Because it uses an existing flat pulley or flywheel, this drive is often more economical to install.

V-belt quarter-turn drives are used to transmit power from a vertical to a horizontal shaft or vice-versa. Due to the peculiar problems inherent in this type of drive, it is advisable to obtain recommendations for engineering and installation from the manufacturer.

The majority of V-belts in use are constructed wth cross-section similar to those in the diagram and have heat resisting properties incorporated in them. V-belts will operate in temperatures as high as 140 deg. F., providing there is some circulation of air.

Other V-belts are available to fit specific conditions. *Where explosion hazards exist, belts with a special static conducting material impregnated in the covers are available.* Where required horsepower per belt is greater than in standard belts and where an absolute minimum of stretch is required, steel cable belts may be obtained. Where excessive oil or grease is contacted, special oil proof, synthetic rubber belts are available to prevent swelling and deterioration.

V-belts may be obtained in A and B section fractional horsepower (FHP) and in A, B, C, D, and E section standard belts. They are available for transmission of from fractional horsepower up to thousands of horsepower in single or multi-grooved drives.

Sheaves also are constructed for a similar horsepower range. Depending upon the requisites of the job to be done, cast iron, or welded heavy-gauge steel plate constructions are available from the stocks of most manufacturers. For the heavier, higher horsepower drives, V-belt sheaves are generally made of high grade cast iron.

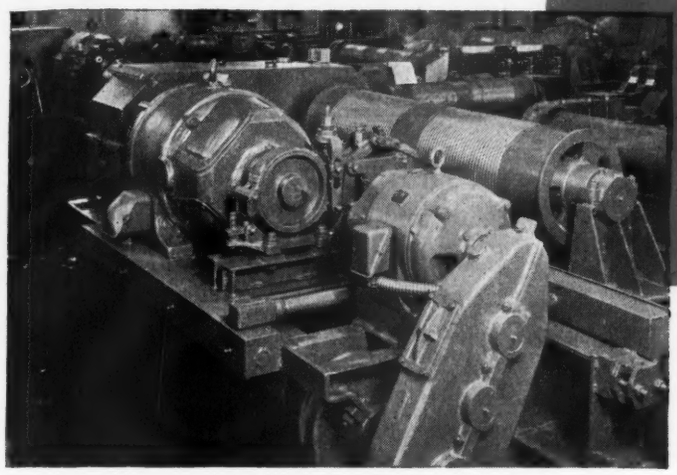
Variable speed sheaves are also available for fractional or multi-horsepower drives.

Many manufacturers are now offering cast iron sheaves with special tapered split bushings to facilitate rapid mounting and demounting by a simple loosening and tightening of several cap or setscrews. These rapid mounting and demounting sheaves are available in B, C, and D sections as stock items. At a slight extra cost, most manufacturers will make any non-stock sheave with this construction.

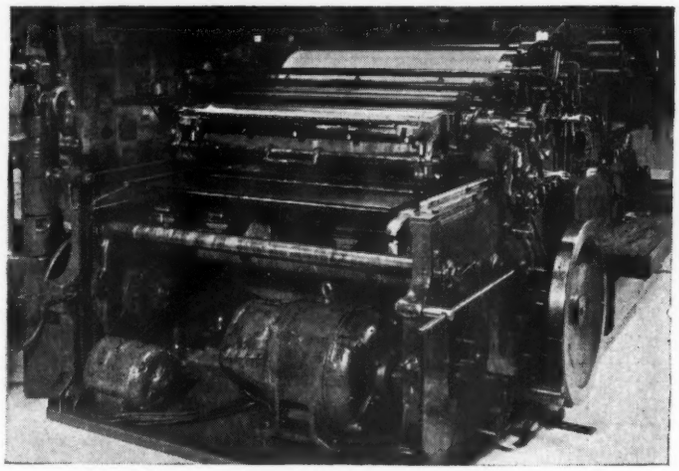
Aside from periodic checking of belt tension, V-belts require little maintenance. Belt wear does occur, however. If observed in time, the type of wear will give a clue as to cause.

Century SLIP RING MOTORS

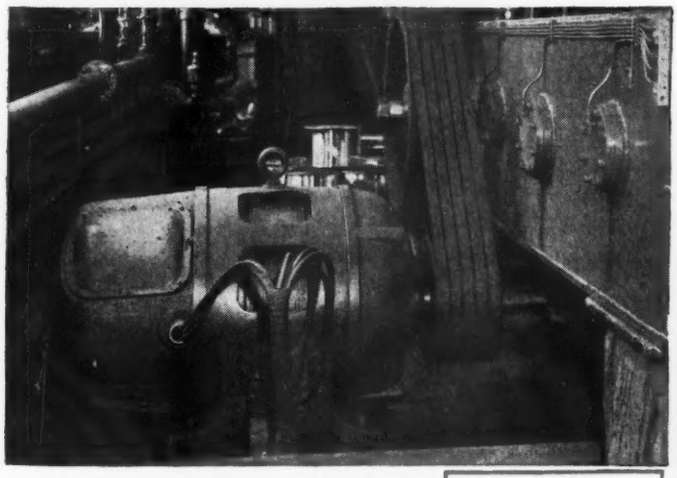
Supply High Torque AND Smooth Acceleration for Applications Requiring...



● 40 horsepower Century Slip Ring motor drives crane hoist and 5 horsepower Slip Ring motor drives crane travel.



● 10 horsepower Century Slip Ring motor supplies flexible power for a printing press.



● 75 horsepower Century Slip Ring motor driving wire plant machine.

Adjustable Varying Speeds
Torque Control
Low Starting Current

Century Slip Ring motors provide flexibility of torque and speed to match varying load requirements of the machines they drive.

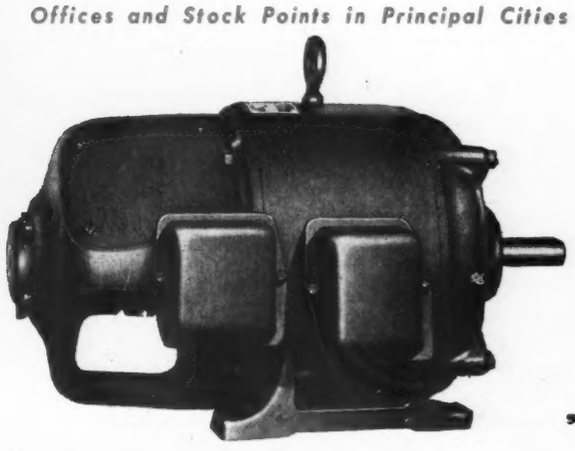
Typical applications for these motors are: cranes, hoists, bending rolls, printing presses, wire mills, bridges, mitergates, locks, dams, conveyors, elevators, reciprocating pumps, and other high impact and inertia loads.

If you have machines that require variable speeds or torques — as well as low starting current — specify Century Slip Ring motors.

Century builds a complete line of electric motors, in sizes from 1/6 to 400 horsepower for all popular electric power applications.

Specify Century motors for all your electric power requirements.

CENTURY ELECTRIC CO.
1806 Pine St., St. Louis 3, Missouri
Offices and Stock Points in Principal Cities



900

Century C MOTORS

DATA SHEET

The number at the right is a classification for convenience in filing and for a future data sheet index

R-2

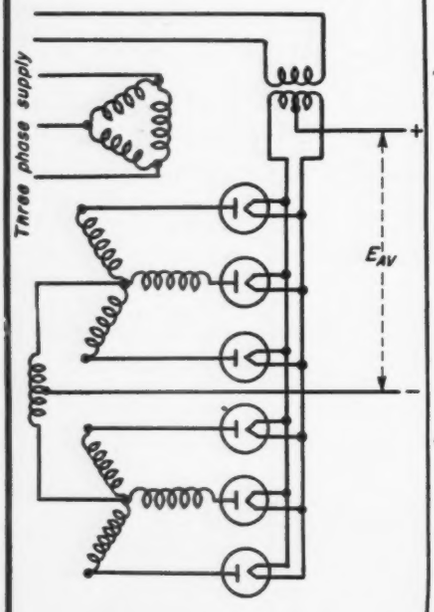
How To Operate Mercury Vapor Rectifier Tubes

Where a power supply is required to deliver high voltage at high current with the utmost in efficiency, mercury vapor rectifiers can be arranged in a number of variations. Successful operation of these tubes depends greatly in the observing of several important precautions.

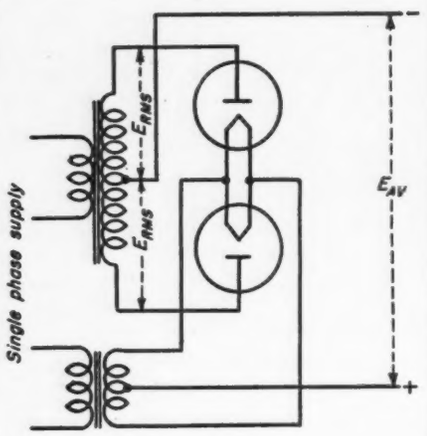
1. **When two or more mercury vapor tubes are connected in parallel, a resistance of approximately 50 ohms should be placed in series with the plate.**
2. **Filament voltage should not vary more than ± 5% of the rated value.**
3. **When new tubes are first installed, or after a long period of non-use, thirty minutes pre-heating time of filament voltage is required to warm the tubes sufficiently to permit the mercury to return to the base.**
4. **Tubes should be mounted vertically.**
5. **Radio frequency fields should be shielded from the tubes.**

The following diagrams represent five power supply circuits using mercury vapor rectifiers. The figures are a theoretical assumption of sine-wave input, zero tube drop and suitable choke input to filter.

THREE PHASE DOUBLE Y PARALLEL (6 tubes)

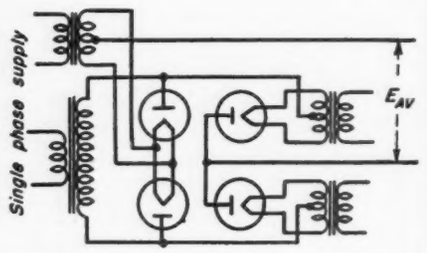


DC Output Voltage Eav
= 0.478 × Einv = 1.17 × Erms
Transformer Secondary Voltage (per leg) Erms
= 0.408 × Einv = 0.855 × Eav
Peak Inverse Voltage Einv
= 2.09 × Eav = 2.45 × Erms
Average Current Iav
= 1.191 × 1 max.
Maximum Average Load Current
= 6 × Max. Average Plate Current per tube



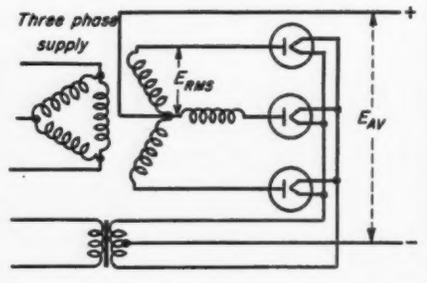
SINGLE PHASE FULL WAVE (2 tubes)

DC Output Voltage Eav
= 0.318 × Einv = 0.9 × Erms
Transformer Secondary Voltage (per tube) Erms
= 0.353 × Einv = 1.11 × Eav
Peak Inverse Voltage Einv
= 3.14 × Eav = 2.83 × Erms
Average Current Iav
= 0.636 × 1 max.
Maximum Average Load Current
= 2 × Max. Average Plate Current per tube



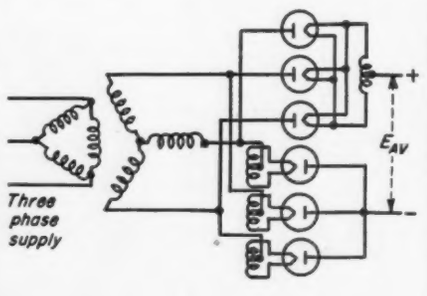
SINGLE PHASE FULL WAVE BRIDGE (4 tubes)

DC Output Voltage Eav
= 0.636 × Einv = 0.9 × Erms
Transformer Secondary Voltage (Total) Erms
= 0.706 × Einv = 1.11 × Eav
Peak Inverse Voltage Einv
= 1.57 × Eav = 1.41 × Erms
Average Current Iav
= 6.36 × 1 max.
Maximum Average Load Current
= 2 × Max. Average Plate Current per tube



THREE PHASE HALF WAVE (3 tubes)

DC Output Voltage Eav
= 0.478 × Einv = 1.17 × Erms
Transformer Secondary Voltage (per leg) Erms
= 0.408 × Einv = 0.855 × Eav
Peak Inverse Voltage Einv
= 2.09 × Eav = 2.45 × Erms
Average Current Iav
= 0.827 × 1 max.
Maximum Average Load Current
= 3 × Max. Average Plate Current per tube



THREE PHASE FULL WAVE (6 tubes)

DC Output Voltage Eav
= 0.956 × Einv = 2.34 × Erms
Transformer Secondary Voltage (per leg) Erms
= 0.408 × Einv = 0.428 × Eav
Peak Inverse Voltage Einv
= 1.05 × Eav = 2.45 × Erms
Average Current Iav
= 0.955 × 1 max.
Maximum Average Load Current
= 3 × Max. Average Plate Current per tube

Data from General Electronics, Inc.

Life-Line
SMOOTH? HERE'S PROOF! Coin balanced on edge on a Life-Line motor remains undisturbed as motor is started, runs and stops—dramatic evidence of Life-Line's freedom from vibration and resulting noise!

QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published, we pay $5.00.

Reader's Quiz

Capacitor Motor

QUESTION 297—How can the correct value of capacitor for a single phase, permanent capacitor motor be calculated? Specifically, we were recently called upon to service a Jennin, ½ hp., 220 volt, 900 rpm. motor. Motor appears to be a regular 2 phase winding, with capacitors in series with one phase. Capacitors were shorted, and had no identification of any nature. This motor manufacturer has gone out of business and his successors could provide no information. Experimenting showed that 10 mfd. would run the motor, but would not provide enough starting torque for dependable operation. 20 mfd. were installed and on a blower are operating satisfactorily. However, starting torque is still so low motor can be prevented from starting by holding the shaft.—W.B.S.

A. TO QUESTION 297 — You will need between a 50 and 100 mfd. capacitor to get strong starting torque, unless the motor uses a large starting capacitor which is cut out later, or a higher voltage is applied during the starting period. For exact results you connect a voltmeter across the capacitor terminals. During the starting period you don't want the voltage to go above 240 volts. I arrived at between 50 and 100 mfd. by figuring between 3 and 5 times full load current during the starting period, and 2 identical windings. You want to make the windings about 90 degrees apart, not 10 to 30 degrees apart, for good starting torque.—H.S.

A. TO QUESTION 297 — A permanent split capacitor motor is essentially a low torque motor. It is designed for fan duty and can be used for multi-speed operation since the capacitor remains in the circuit at all speeds. The capacitor must be an oil filled type.

This type of motor should be used with direct connected fans, the torque being too low when starting to overcome friction if belt driven fans are connected.

My custom has been to use an outfit made up of capacitors of different values so that by throwing switches I can insert capacitance of different values in the circuit.

Since the motor might be used for multi-speed operation, I reduce the voltage to 60 percent of normal voltage and raise the capacitance until the motor starts the fan. The object of this is to be sure that when the motor is run at low speed and controlled by a thermostat it will be sure to start when the thermostat closes.

A capacity outfit to produce from 5 to 30 mfd. would be sufficient to take care of motors from 1/12 hp. to ½ hp. and could be made up by using a very few capacitors since various values can be obtained by connecting the capacitors in series or in parallel. These outfits can also be purchased from capacitor manufacturers.—B.A.S.

W. L. Thomas (left), electrical inspector, Oklahoma City and Charles A. Henderson, assistant electrical engineer, Tinker Air Force Base, Oklahoma City, discuss safety precautions for electrical installations in hazardous locations at recent Denver convention of the Western Section, IAEI.

Series Lighting Circuit

QUESTION 298—I had an airfield lighting circuit that was grounded. There were 97 lights on the circuit with individual transformers for each light. Primary voltage 4160 with a secondary voltage of 140 volts at each socket. Output of each transformer has 50 watts.

In making tests I burned out two voltmeters set on the 600 volt scale. By putting a statiscope on the secondary leads, I would get a light indicating a primary leak, yet by plugging in the 50 watt 120 volt bulb it not only did not burn out but burned at its usual brilliancy. Several bulbs were used to make sure that it was not the bulbs.

Why did two voltmeters burn out indicating in excess of 600 volts, a light show on a statiscope indicating primary voltage and yet an ordinary 50 watt 120 volt bulb burn several hours without burning out?—F.A.S.

A. TO QUESTION 298 — In checking the information shown in above question, I believe the voltmeters that were used were not a-c voltmeters. The fact that the 50 watt 120 volt lamps did not burn out immediately indicates that the voltage was not excessive; furthermore, when 120 volt lamps are placed in circuits of 220 volts or higher, they burn out immediately and I have seen the glass blister in some instances.

Regarding the statiscope, the use of this instrument will not indicate true readings and I believe is not the correct instrument to use for this test.

The question does not indicate whether the ground is on the secondary or on the primary circuit, if on the secondary circuit there should be some way of disconnecting at each transformer so that each light circuit could be tested separately and I suggest the use of a "Megger" for this test. If the ground is on the primary circuit the

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same test with the "Megger" can be used; however, be sure to disconnect main source of supply and watch for feedback through transformers.—T.R.

A. TO QUESTION 298 — The secondary ground is broken. This allows the primary ground to be on one side of the primary winding and the secondary to get connected by means of a high or low resistance joint to the other side of the primary winding. The 50 watt lamp was connected across the secondary which developed 140 volts. The close socket spacing would act as a spark gap on the 4160 volts, but the 600 volt voltmeter was connected across the 4160 volt primary by attaching one lead on the ground which was on one side of the primary, and the second lead to the secondary which was on the other side of the primary. The statiscope also measured the 4160 volts which burned out the voltmeters. The primary would behave the same way if it is grounded in the center, since this would place 2080 volts between the secondary and the ground.—H.S.

A. TO QUESTION 298—From your description, it would seem that this is a series lighting circuit with the primaries of all the transformers connected in series. In a circuit of this type, the volt ampere output of each isolating transformer tends to remain constant. With the proper lamp in the socket, in this case a 50 watt lamp, the secondary voltage is accurately read with a voltmeter. If this lamp is removed from the socket and the open circuit voltage of the secondary is read with a voltmeter, it will be found that the voltage is much higher. This is due to the fact that the voltmeter has a high internal resistance and therefore pulls very little current. In order to have the same volt-ampere output, the voltage must be higher. In your case the voltage was probably considerably in excess of 600 volts and damaged your meter. These lights should be equipped with a cutout of some type so that if a lamp burns out or is removed, the secondary of the isolating transformer will be shorted out.—F.C.

A. TO QUESTION 298—From the question it seems there is a series circuit with the 97 transformers connected in series (on the primary), each transformer supplying a 50 watt, 120 volt bulb.

In such a case even though there is no breakdown in the transformer insulation, there would be a high voltage set up in the secondary of the transformer when there is no load being supplied. Under normal conditions when the secondary is connected to a device or load such as a lamp, the

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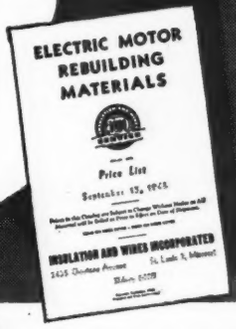

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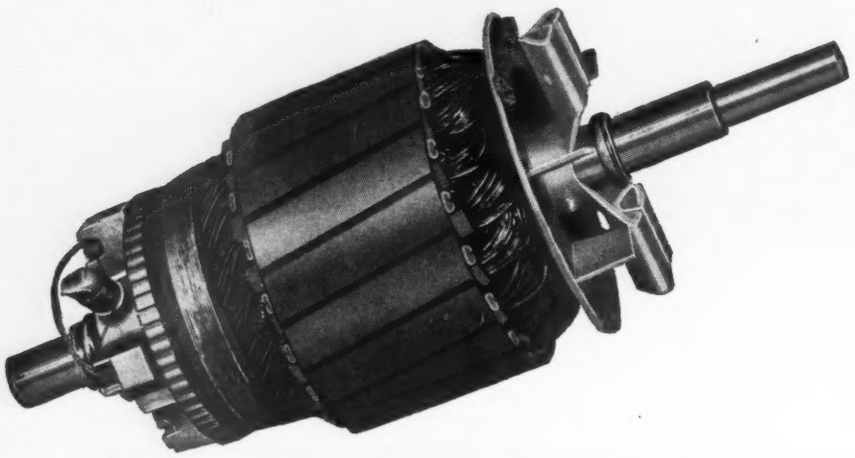

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secondary current sets up a magnetic field in opposition to that produced by the magnetic field is not so great and the secondary voltage is kept down.

If the resistance in the secondary circuit is increased the current is decreased and the resultant magnetic field becomes stronger so that a greater voltage is set up. This causes the characteristic tendency of this type of transformer to maintain a "constant current". When the secondary circuit is open the resulting voltage may be very high (even dangerously so) and may cause failure of the insulation.

When a voltmeter, which is a high resistance instrument, is connected across the secondary, it is very likely that the meter will be burned out. Voltmeters vary, but a 600 volt range instrument might have a resistance of 60,000 ohms with a current carrying capacity of .02 or .03 amperes. A current of .01 ampere would give full scale deflection. Since the secondary current for a normal load (50 watt, 140 volt lamp bulb) would be .4 to .5 ampere, it can be seen that the meter element would burn out before the current could reach the normal value.

The statiscope draws no current (practically) so it would indicate a high voltage even if the resistance is still in good shape.

If the circuit has been open because the lamp was removed or burned out and the safety shorting device did not work, it is likely that the insulation would be broken down. In such a case, there could be high voltage which would indicate on the statiscope or burn out a voltmeter and at the same time the resultant current through a light bulb might be very little more than normal, if the lamp socket is fairly well insulated. Exact conditions would depend on where the insulation had broken down and the resulting current paths. It might connect the lamp as a shunt or parallel path across some turns of the transformer.—J.E.W.

Can you ANSWER these QUESTIONS

QUESTION Y13—I operate a plant containing numerous solenoid-operated switches, contactors, dashpots and magnetic valves. This plant is situated at the end of an overloaded and unbalanced 3-phase 2400-volt distribution system, with power stepped down to 220 volts for motor and solenoid operation.

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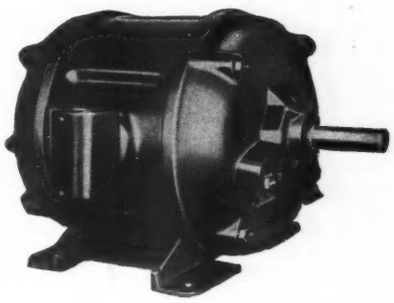

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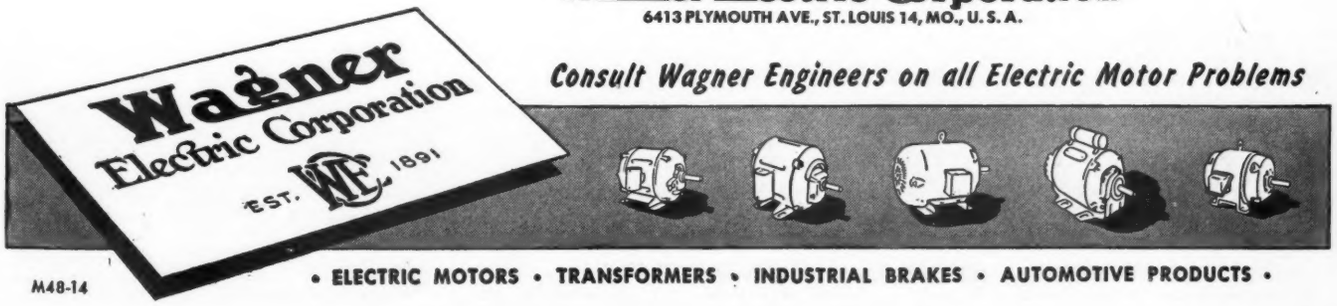

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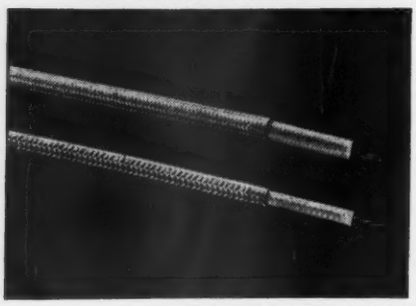

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on our feeder play hob with the power factor. Lights of lighting circuits go on and off incessantly and frequent starting and stopping of split phase motors cause continuous wavering of system unbalance.

As a result of this evil combination our magnetic coils give us trouble by heating, humming, partly releasing their holding load and sometimes by burning out. Both factory-made and home-made coils give us trouble. But the latter gives the best service and lasts longest. A greater proportion of iron than in factory designs also helps.

While I have had some success with my own coil designs to meet these operating conditions, I would like to have practical information on winding coils for varying voltage (200-220 volts), variable frequency (57–61 cycles), varying power factor (.75 lagging to 1.05 leading) and with varying phase unbalance by 20%.—G.H.

QUESTION Z13—We have a bank of transformers delivering three phase power at 230 volts. Load consists of general laundry equipment, deep well pumps, cold storage and air compressors and electric bakery oven and equipment. Total resistance load accounts for approximately 15 percent of the total load of 150 kva., the balance is squirrel cage across-the-line motors. Voltage is controlled with 165 kva. auto transformer and 135 kva. capacitor. All present equipment is rated for 220 volts a-c.

It is proposed to install larger transformers delivering three phase current at 208 volts. Present power factor over long period of time has been maintained by close attention to efficient loading, at 97.1.

What effect would the change from the higher voltage to the lower have on operating conditions, power factor, etc.

No lighting is supplied from this system.—J.B.J.

QUESTION A14—We have a dual (220-440) voltage, 3 phase, 25 cycle, 7½ hp. induction motor that does not conform to the action of other motors under the following test:

One Y group is connected to 220 volt and the rotor turns clockwise. This group is disconnected and the second group is connected to 220 volt and the rotor again turns clockwise. When both groups are connected in parallel, the rotor runs counter clockwise, unlike other motors in our shops. All coils have been checked out by kick tests to determine associated groups and proper polarities. We use N.E.-M.A. markings. The motor runs a little warm, but is apparently O.K.—A.H.J.

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Chief Inspector, New York Board of Fire Underwriters, New York, N. Y.
Electrical Engineer, Fire Underwriters Inspection Bureau, Minneapolis, Minn.

Questions on the Code

Aluminum Conduit

Q. *I have received a rejection notice from the inspector because I used a piece of aluminum conduit on the haymow circuit in a dairy barn. I have searched through the Code and am unable to find any section that would prohibit the use of aluminum conduit. Is this some new ruling of the Code committee, or was it just the inspector's idea?—M.L.L.*

A. No direct reference can be found as yet in the N. E. Code which pertains to the use of aluminum conduit, except that Section 1110 does state that no conductors or equipment shall be located in a damp or wet location; where exposed to gases, fumes, vapors, liquids or other agents having a deteriorating effect on the conductors or equipment, nor where exposed to excessive temperatures unless approved for the purpose.

Experience has definitely proven that some aluminum conduit and certain aluminum fittings are unable to withstand the corrosive conditions common to buildings housing livestock. I have in my possession samples which have been destroyed within a year's time by the corrosive conditions found in these buildings. On a certain specific sample it was found that the fittings were produced from pure aluminum sheet stock. There are also known cases where aluminum has withstood these conditions but in each case the metal used was an aluminum alloy.

In my opinion the electrical inspector who refused to accept the aluminum conduit for a haymow circuit was correct in taking such action unless the manufacturer of the conduit could assure you that the material used was capable of withstanding corrosive atmosphere found in the buildings.—G.R.

Conductors

Q. *We are planning to use a number of solenoid controlled switches with the control circuits energized by a transformer having a secondary current of 24 volts at 1 ampere. If we use thermoplastic insulated transformer wire for these circuits, must it be separated by metal from the power conductors within the switch box?*

A. Yes, there must be a barrier or partition between the Class 2 conductor and the power conductors. It need not be metal but may be of fibre or any other of the commonly used materials. Section 7292-a-2 permits the use of a common enclosure for Class 2 and power conductors only when the power circuit enters the enclosure for the sole purpose of supplying energy for the remote control or signal circuit.

If the conductors used for the control circuits have insulation similar to that used for the power or light circuit, they may be placed within a common enclosure.—G.R.

Control for Gasoline Dispensing Pump

Q. *Section 5142e has been a source for plenty of arguments during the last few days among the gang and I hope the results of this letter will clear all the questions of those concerned.*

As it stands, we have a pump with two circuits, one for the light and the other for the pump motor. These circuits terminate in a "GUAC" condulet. We are using a RED wire at one side of pump motor circuit. The other side of these circuits, which are the WHITE wires, are spliced together with the white feeder wire leading back to the panel, from where this pump will be controlled.

Will you please explain how the wires should be connected as required by Section 5142e—M. O.

A. Paragraph e of Section 5142 requires that all circuits supplying current to gasoline dispensing pumps be controlled by switches having a pole in each conductor.

This means that if a 3 wire circuit supplied by a 3 wire system is used, there shall be a disconnecting pole in each leg of the circuit and if 2 wire circuits are used a double pole switch is to be used. Of course if the supply system has a grounded neutral there is to be no fuse in the neutral conductor, although the neutral must be broken by the switch.

The above may be readily accomplished by the use of circuit breakers and the trip coil may be left in the neutral, provided all legs are opened simultaneously.

With fused switches where the neutral is not to be fused, the neutral fuseholder may be made solid.

With unfused switches the use of double pole switches satisfies the requirement. Underwriters Laboratories do not consider that after the circuits reach the pump, the use of double pole switches is necessary to control the pump motor nor the lights, as they list pumps having single pole hook switches.—F.N.M.S.

Disconnecting Means

Q. *When a separate circuit is used for an oil burning furnace, is it not possible to consider the fuse or breaker protecting the circuit as the disconnecting switch for the two motors on the oil burner?—J.A.H.*

A. If the overcurrent protective device is within sight of the motor controller they may be considered as the disconnecting means. If the circuit protective device is not within sight of the motor controller and cannot be locked in the open position a separate disconnect must be provided. These provisions will be found under Section 4241 of the N. E. Code.—G.R.

Appliance Circuit

Q. *Does the Code require the use of a 20 ampere fuse on an appliance circuit supplying outlets in the kitchen, dining room and laundry.—J.J.B.*

A. No, the Code does not require the use of a fuse or circuit breaker rated at 20 amperes on the small appliance circuit in dwellings. It may be protected by devices of any rating not in excess of 20 amperes. Section 2115-b states that conductors used for such circuits shall be not smaller than No. 12, and then under Section 2127 you will note that the appliance circuit is not governed by table contained in that section.—G.R.

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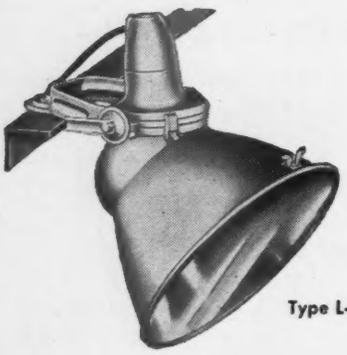

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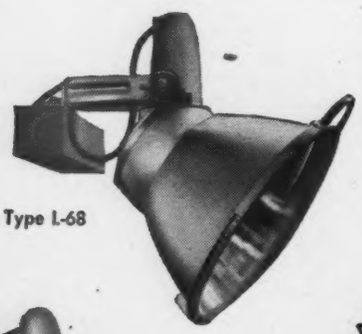

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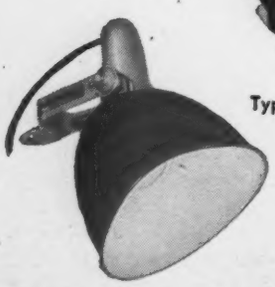

Type L-45

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Insulating Transformers

Q. *In the National Fire Protection Association's pamphlet entitled "Combustible Anesthetics in Hospital Operating Rooms", Section VI, under Arrangement of Circuits, it is recommended that all electrical circuits be fed from a line insulating transformer of the dry type installed outside of the hazardous location. Also that it be considered a special form of "branch feeder". It is further recommended that the primary winding be protected by the usual protective device and that both sides of the secondary circuit be likewise protected.*

1: *If a transformer of suitable size is not available, can more than one transformer with secondaries connected in parallel be used?*

2: *If this is permitted by the Code, what over current protective devices are required and in what conductors should they be placed?*—C.H.B.

A. Transformers may be in parallel but must be provided with overcurrent protection in accordance with Section 4512.

The rules in Section 4512 would permit the transformers which would constitute a bank of transformers operating as a unit, to be classified as a transformer for the purpose of applying the requirements.

While the National Code permits, in general applications, the omission of the protective devices in the primary connection, provided the primary feeder is protected as stated in paragraph b of Section 4512, the NFPA recommends the protection in both the primary and secondary connections for installations of the nature in question here, and this recommendation should be complied with.

Also note that with this type of installation, the NFPA recommends protective devices in both sides of the secondary circuit.—F.N.M.S.

Lighting Fixtures

Q. *We have been advised time and again that the Code does not allow the use of any kind of a lighting fixture within a booth and yet we have just connected wiring to several booths bearing the label of approval of the Underwriters' Laboratories that have labeled vaportight fixtures mounted on the top at the open end. These booths are fairly shallow and the operator stands outside. If such a lighting installation is correct, why*

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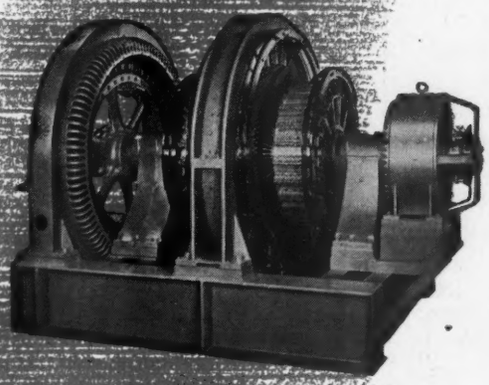
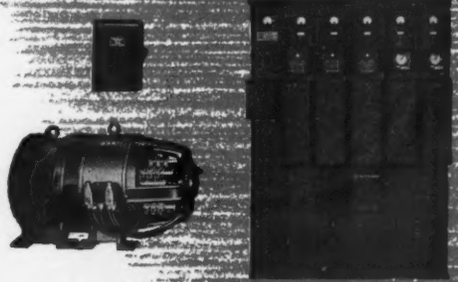
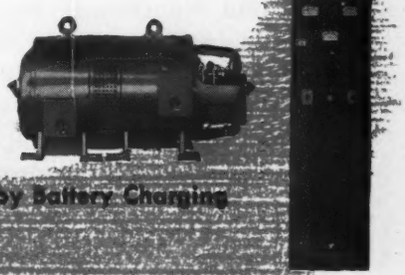


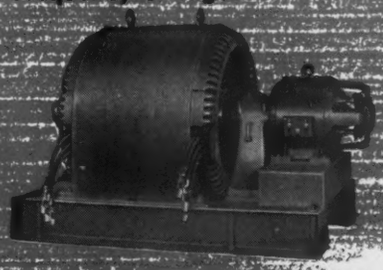
For Electrolytic Processes



For Industrial-Truck Battery Charging



For Standby Battery Charging



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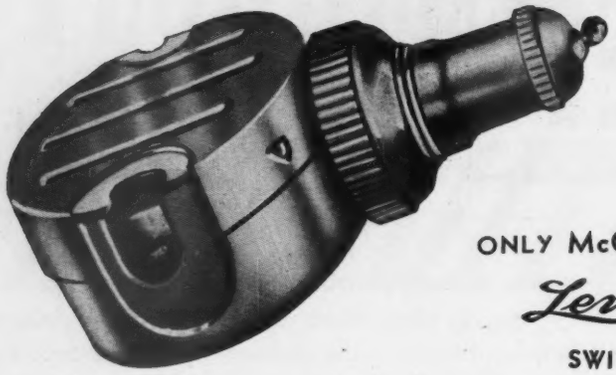

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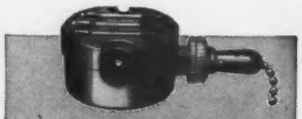
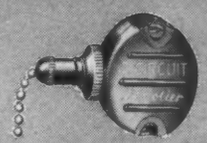
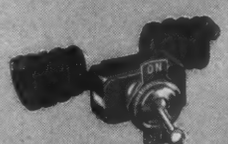


No. 1010—10 amp., 125 volt fluorescent control. Special "T" rating.



No. 201—3 amp., 125 volt, 2 circuit canopy pull switch.



No. 25—6 amp., 125 volt toggle switch. Single pull wire leads, "T" rating.

No. 285—6 amp., 125 volt. Double pole, double throw.

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Electrical Division

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does our inspector insist that the Code prohibit fixtures within a booth?—R.V.

A. The Code clearly states under Section 5003a that "No electrical equipment of any type shall be installed or used in any location where readily ignitable residues may be deposited." The Underwriters' Laboratories approval of any device or appliance does not assure that it will not be misused. If the approval booth in question is so used that the vaportight fixtures are subject to the paint residues, the fixtures should be removed as their use would then be a violation of the Code. However, if the booth is used for the spray painting of the type of device for which it was intended, you will find no deposit of paint residue will accumulate. Inasmuch as it is usually impossible to locate a fixture within a booth which is not likely to collect an accumulation of paint residue, inspection agencies refuse to accept such means of lighting and either require that the fixtures be outside at the open end or be mounted behind wire glass panels built into the ceiling and/or side walls of the booth. —G.R.

Motor Protection

Q. *When delayed action fuses are used for motor running protection, is it not possible to use two such fuses for the protection of a three phase motor?—L.A.Z.*

A. No. Each ungrounded conductor must be protected whenever fuses are used for motor running protection. See Section 4326. The Code permits the use of such devices as trip coils, relays or thermal cutouts on only two of the three ungrounded conductors supplying a three phase motor. See Section 4327.—G.R.

Clevelanders in an after-session huddle at recent Denver IAEI meeting are: (L to R) Otto E. Radtke, chief electrical inspector; Charles Stasek, theatre inspector; and Charles Kenig, Electrical League of Cleveland.

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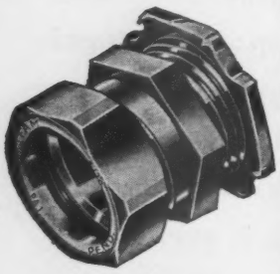

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Grain Elevator Wiring

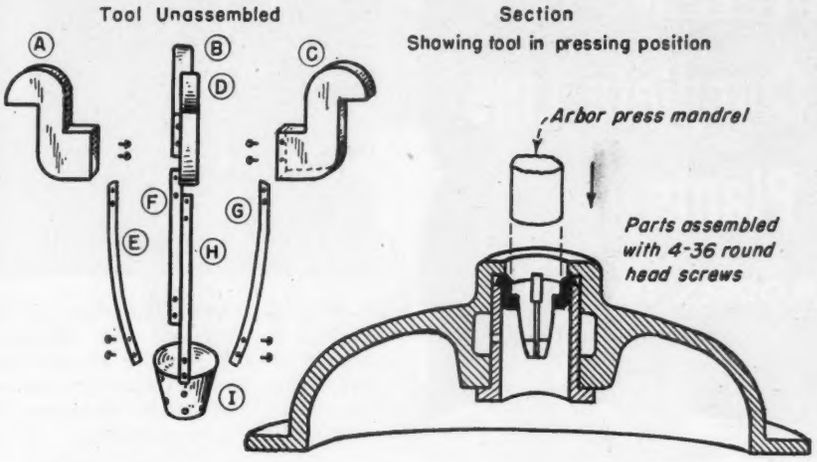
Q. *Just a year ago we wired a grain elevator using rigid conduit. Recently we were called back because a feeder conduit running from the distribution cabinet in the office across the ceiling of the driveway to the work floor had broken. Apparently the elevator bins had been emptied and the expansion of the building had placed too much strain on the conduit run. Where such runs are necessary, does the Code recognize some type of flexible joint so that this expansion problem can be met?—E.R.R.*

A. Yes. The N. E. Code under Section 5054a-2 permits the use of short sections of flexible metal conduit where necessary. The expansion and contraction of a wooden grain elevator can vary the overall height of that section containing the storage bins as much as a foot or more. This is caused by the weight of the grain in the bins and is more pronounced in an elevator of balloon construction than it is in a cribbed house.

You perhaps have noticed that when the building is filled, the work floor will be about level with the driveway, but when empty that floor may be a step or more above the level of the driveway. Therefore conduit runs entering or leaving that section containing the grain bins must have flexible sections to permit this vertical movement. Some vertical runs, especially those extending from the booths to the cupola, must also contain telescoping joints. In all cases where the flexible connection or joint does not assure good electrical continuity between the rigid conduits, a grounding jumper must be employed.—G.R.

L. S. Crain, chief electrical inspector, Nebraska REA, and W. C. Boon (right), chief electrical inspector of Topeka, Kansas, air rural wiring problems at Western Section, IAEI conference.

Motor Shops



Ⓐ Ⓑ Ⓒ Ⓓ *Parts are identical (made of tool steel hardened)*

Ⓔ Ⓕ Ⓖ Ⓗ *Parts are identical (flexible-hardened spring steel)*

Ⓘ *Short piece of $\frac{3}{4}$" cold rolled bar stock slightly tapered*

Diagram and parts list for the arbor press tool used on sleeve bearings that are difficult to remove from end bells.

Tool for Removing Sleeve Bearings

Removal of sleeve bearings is often difficult in motors where the bore in the end shield (or end plate) is the same as that in the bearings. Regular arbor press mandrels cannot be used in such cases and make-shift methods, such as use of key stock, trimmed flat washers and knock-out punches, are frequently employed. Lack of success and loss of time make such attempts costly.

Gilbert J. Fontes, a machinist at Walco Electric Products Company, Providence, R. I. motor service shop, has one answer to the problem. He designed and built a bearing removal tool that can be used with an arbor press.

The idea—a description of which follows—was submitted as an entry in the 1948 NISA Awards Contest and is released for publication through the courtesy of the 1948 Awards Committee of the National Industrial Service Association.

The tool consists of four S-clamps made of hardened tool steel. These are attached—diametrically opposite each other—to a tapered steel "bob" by short strips of flexible hardened spring steel (see sketch). When the tool is inserted in the bearing, from the front of the end bell, the S-clamps will spread out and hook over the end of the sleeve bearing. Experience in the Walco shop shows there is generally sufficient space between the back of the end bell and bearing to permit the clamps to slip in.

The end bell is then placed in an arbor press. A mandrel with a diameter $\frac{5}{8}$-inch less than the bearing bore is used. As the mandrel is lowered it rests on the inside projection of the S-clamps and forces the sleeve bearing out.

Several tools are used in the Walco shop. Their size varies according to the bore and wall thickness of sleeve bearings most frequently replaced.

Shop foreman, Philip Grasso, and assistant, Rito Dominick, lower motor frame to stripping table where assembly is clamped by three hooked anchors. Anchors slide in radial grooves to fit any sized motor frame, are tightened from beneath the table by handwheels and are prevented from slipping through slots by collars.

Adjustable Clamps For Stripping Table

In the motor shop of the Davidson Electric Company, Brooklyn, New York, the stripping table is located immediately in front of the okite tank. When coil varnish has been softened sufficiently in the hot liquid, the wound unit is lifted from the tank by means of a chain hoist and lowered to the surface of the stripping table where old windings are removed before unit cools and residual varnish rehardens.

While old windings are being removed, units are held securely on the table by means of three clamps. These clamps are composed of anchor irons, threaded on the lower ends and bent to form holding hooks at the tops. Anchor clamps can be moved towards or away from the center of the table at ease, since three radial slots in the table top run from the center of the table outwards. Anchors are adjusted so that the hooks grasp the upper lip of the unit being stripped, and the clamps are then tightened by wheel locks located beneath the table surface and easily spun and tightened by hand. To prevent anchor rods from slipping through the radial slots to the shop floor when the table is not in use, collars have been fashioned. These cylindrical collars permit the rods to be freely raised, lowered or shifted in position, yet, being larger in overall diameter than the width of the slots, prevent the rods from dropping.

Lightweight Frame For Stock Areas

Trim, sturdy frames support wooden shelves in the stock area of the recently-completed structure which combines office, shop and storage departments for the Superior Electric

Typical of Universal's many gasoline powered models is this widely used 700 watt set. Other gasoline models to 25,000 watts.

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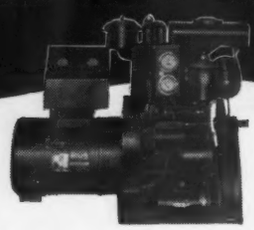

This Universal air-cooled Diesel electric plant develops 2000 watts. AC and DC models to 36 kw.

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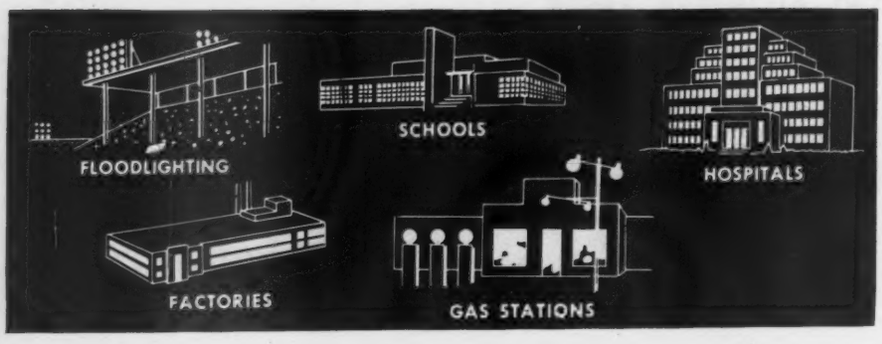


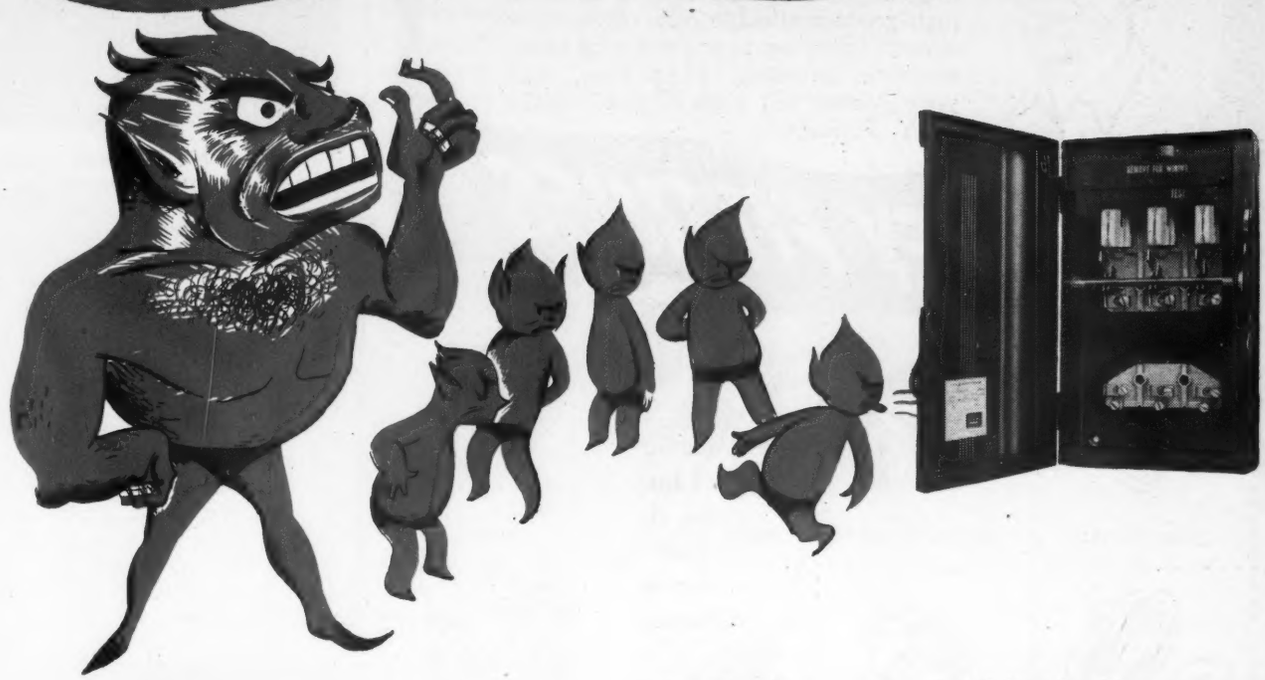
Welded framework of channels and angle-irons supports oak shelves in storage area of Superior Electric Company. Construction is sturdy, trim and results in maximum clearance for stocked parts and materials.

Company of Springfield, Mass. After analysis of the stock to be carried, the dimensions of the various cartons and the weights involved, the width and spacing of shelves was determined by President George Williams and the framework was assembled in the shop. The framework consists of steel channels and angles, channels being used for uprights and end cross members, and angles used for longitudinal side strips. All connections are welded, resulting is a rigid frame that will support materials and incidental loads without cross bracing. Longitudinal side angles are welded with the horizontal legs beneath the wooden shelves of oak. In this manner, clearance between shelves is maintained at a maximum and shelves are prevented from shifting and dropping. Frames in the center of the storage area are considerably wider than those positioned along the walls, since wall shelves are approached only from one side while storage racks in more open locations carry double rows of stock and can be approached from both sides. The framework is painted with aluminum, giving the assembly an unusually trim and lightweight appearance.

Handling Aids for Baking Oven

In the motor repair shop of Alfred L. Brown Associates, Inc., Worcester, Massachusetts, the movement of motors between the baking oven and other areas of the shop is greatly facilitated by means of special rolling dollies and an electrical monorail crane. The feature that makes the dolly particu-

HEAT is foiled here!



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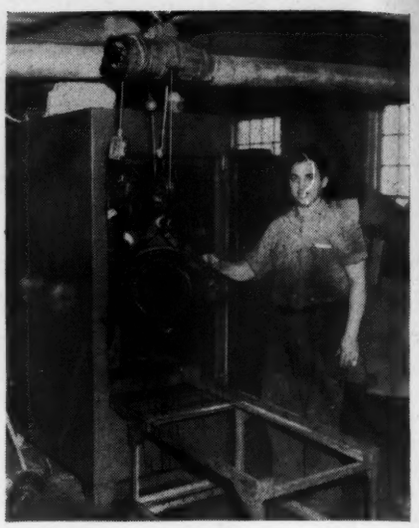

Walter Rabidou positions special rolling dolly in front of oven in motor shop of Alfred L. Brown Associates, raising hinged dolly extension to level of oven floor while suspending freshly-dipped motor from electrical push-button monorail hoist.

larly useful is a frame-work extension on one end which may be raised to extend the horizontal area of the dolly, or can be lowered to minimize the floor space occupied by the unit. Since the level of the special dolly is the same as the level of the oven floor, the framework extension establishes a continuous horizontal channel arrangement from dolly to oven. Large motors, placed on a rolling grid, can be wheeled about the shop on the dolly and pushed directly into the oven with minimum effort. Where lifting is necessary, the pushbutton electrical hoist can be positioned directly in front of the oven door and operated by fingertip control. Fred M. Shaw, president of the organization, states that small motors are hung from a framework of hooks which slides into and out of the oven at roof level. Larger motors are placed on the rolling grid previously mentioned and are baked in an upright position.

Electrical inspectors Dan M. Allison, Monongahela Power Co., Parkersburg, W. Va., and John C. Denner, Saginaw, Mich., listen to an inspection anecdote of Howard A. Jaberg, chief of Cincinnati's electrical inspection bureau.

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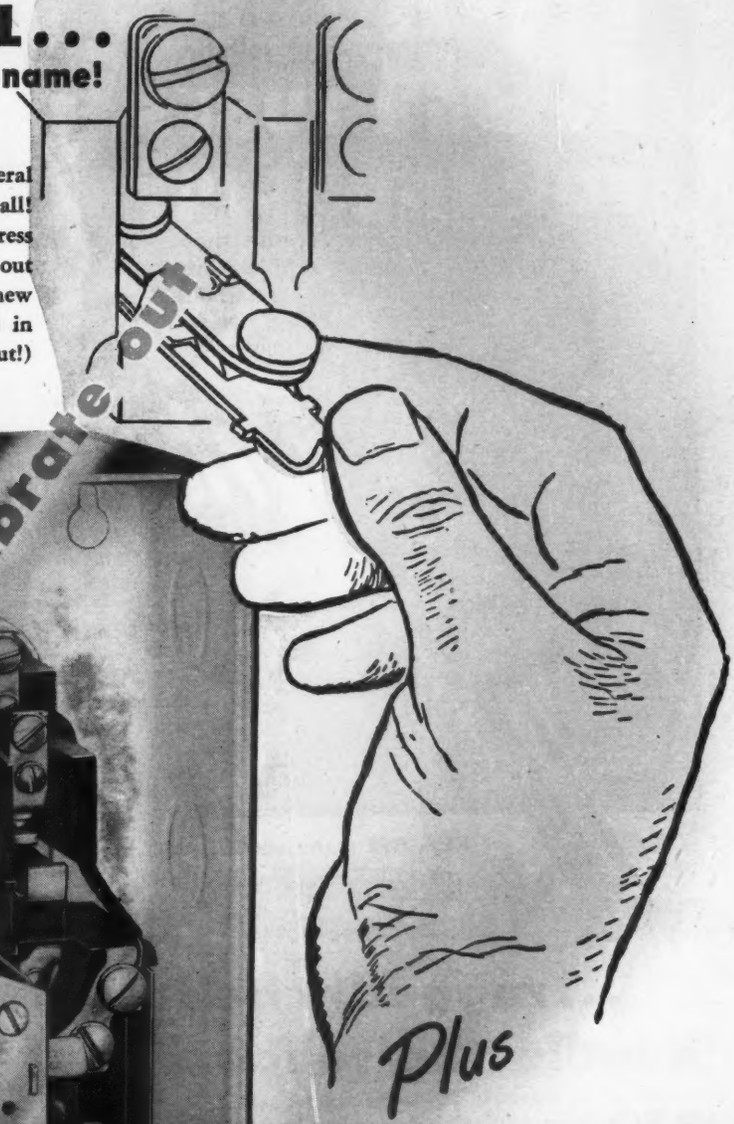

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TUBE DEPARTMENT
RADIO CORPORATION of AMERICA
HARRISON, N. J.

MOTOR TEST METHODS

[FROM PAGE 69]

fugal switch may be not making contact in just one spot. Locked rotor will show good, except on this spot.

In using locked rotor for starting torque, the maximum starting torque of the motor will be that torque which it will start and accelerate not nine times out of ten, nor 49 times out of 50, but every time. This will be the minimum locked rotor torque shown at any position of the rotor, and who wants to take a locked rotor test in about ten different positions of the rotor?

Another instance of testing with locked rotor is in polyphase squirrel cage motors with low slip rotors, such as are used in textile work. A one hp. motor had a locked rotor of 100 percent. It would start 100 percent load and turn it at about 100 rpm. But the load had to be slackened off to 25 percent before the motor would accelerate and bring the motor up to speed. Though the locked rotor torque of this motor was 100 percent, the actual starting torque of this motor was only 25 percent. I have encountered a number of such polyphase motors.

There are a number of types of dynamometers on the market. Those using an electric generator for a load brake are excellent for testing motors under a running load. They usually provide a means of locking the rotor and stator together for checking locked rotor torque. But in my opinion they are not too good for checking starting torque, for reasons which are evident. Hydraulic and friction brakes are also good for testing. With these we can get starting and pull in torques. The determining factor with these would seem to be the speed with which adjustments can be made from no load to stalling the motor, releasing the load gradually to get the starting and pull in torques and then full load, while we get full load amps, watts, and rpm. This speed adjustment is most important, aside from the consideration of time saved. In testing split phase motors, as an example, if we take more than three or four seconds to bring the motor from full load speed, down to a stall, allow it to start, pull in, and come up to speed again, we will have the starting winding smoking. Yet, in testing these motors, I want to be able to start, come up to speed, stall, start, pull in and up to speed at least a dozen times, without shutting off the current, before I will consider

such a motor tested. The same applies to capacitor start motors, with condensers rated for 20 starts per hour, with each start not over 3 seconds duration.

We believe that the old fashioned perhaps, but still the simplest and fastest means of testing is that still used by most factories for motors up to one and two horsepower—the pulley with rope or cord brake. This is not so good where you wish to run a motor under load for an hour or so, as it requires periodic adjustment, but for fast testing to get the starting, pull in maximum torque, full load amps, watts, and rpm., in a matter of a few seconds, we believe it can't be beat. For making a heat test, for some duration we use an electric brake.

Instruments used should be capable of reading the locked rotor current of the largest motor tested, down to the no load current of the smallest motor to be tested. This usually covers a considerable range. On a brake for fractional hp. motors, we use a 300 volt voltmeter, one 10 ampere and one 50 ampere meter. These are connected in series, with the ten ampere meter normally shunted out by a heavy pushbutton. This gives readings of from 2 to 50 amperes. When readings are below 10 amperes on the 50 ampere meter, the pushbutton is pushed allowing current to be read on the 10 ampere meter. This system prevents burnouts of meters. With current transformers, one is too apt to leave the transformer on a low range, and then put high current on a motor. Wattmeter is 1500 watts on 110 volts, 3000 watts on 220 volts. This range has been very satisfactory for motors up to 1 or 1½ hp.

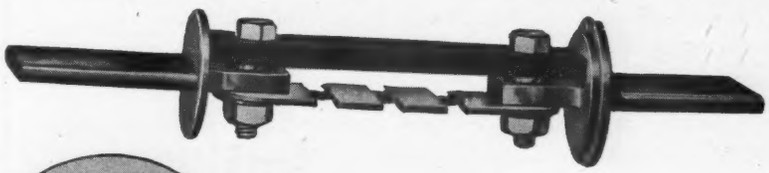
One other factor would seem to emphasize the need of more testing equipment in more shops. This is the new NEMA specifications for motors, which, in combination with most manufacturers tendencies to cut down the physical dimensions of many motors (what used to be ½ hp. motors are now being rated as ½ hp. etc.) has given what has been called the "New Look in Motors". It means that many of the "New Look" motors must be right up to 100 percent in all characteristics to be able to perform the same job that some of the old "dogs" would take in stride.

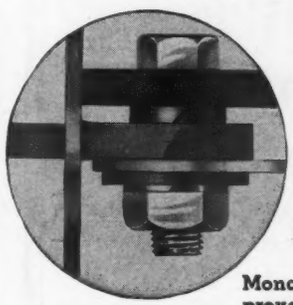
No electric motor repair job can be done completely without a thorough test of the motor. Such a test can not be made without (1) adequate equipment and (2) a knowledge of the characteristics of motors to be tested.

New POSITIVE LOCK
Construction of
Monarch Renewable
Fuses
Assures →
TRUE ALIGNMENT

The brass lugs inside the caps used on Monarch Fuses (see illustration at right above) fit into equally spaced slots in the brass casing inserts. This new and improved Monarch construction assures true alignment of the copper holding terminals . . . and establishes a positive lock on both ends of the fuse.

and for
STILL GREATER PROTECTION . . .





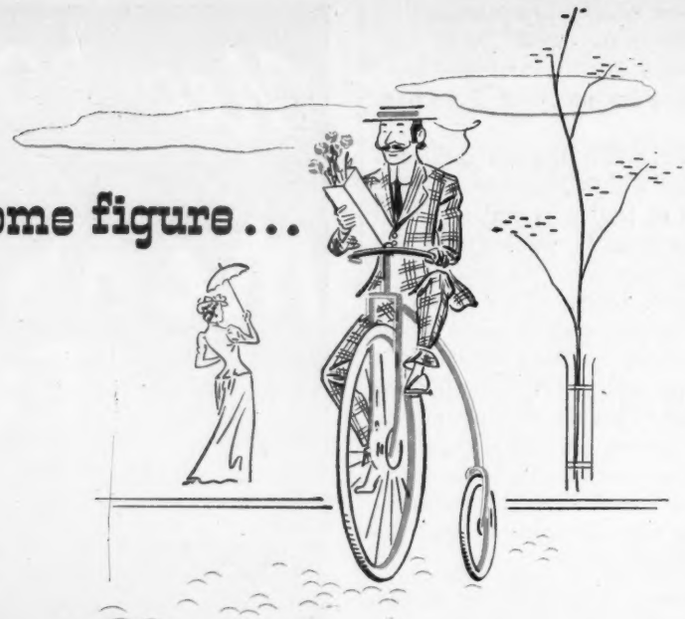
MONARCH'S Compressed Tension Lock Washer construction (illustrated at left) compensates for contraction and expansion of the fibre bar by exerting constant tension on the bar . . . and assures no loose parts. The washer also separates the fibre bar from the copper terminals . . . a spacer to provide better cooling.

Monarch Fuses are fully approved and are available through recognized wholesalers.

Specify Monarch Fuses
for improved
FUSErvice

MONARCH FUSE CO., LTD.
118 E. FIRST ST., JAMESTOWN, N. Y.

how to cut a handsome figure...



(EXAMPLE)
cut $3200* from your annual power bill WITH WESTINGHOUSE CAPACITORS

YOU CAN BE SURE IF IT'S Westinghouse

It is reasonably safe to say that low power factor is costing you money . . . money that could be turned into savings. As an example, take the case of a Texas textile mill that is saving $3,200 annually through an installation of Westinghouse Inerteen Capacitors that originally cost $3,261.

Yours may be a similar case in that you are paying a premium for current that does no useful work. This premium may be in the form of a high demand charge . . . in a penalty clause, or in failing to earn a high power-factor bonus granted by the power company.

Actually, capacitors offer predictable savings. It is not unusual for them to repay their cost in 8 to 24 months. But "billing savings" is only one advantage to be gained from capacitors. Others, equally important, include better voltage regulation, brighter lights, better motor starting and running performance, more capacity for new loads.

For more information about Inerteen Capacitors, ask for booklet B-3966. Call your nearest Westinghouse office or Westinghouse distributor. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-60674

**Details of this installation are available on request.*

These features assure longer life . . . better performance.

- **Inerteen Impregnation** — *smaller, lighter, fireproof units.*
- **Solder-sealed Porcelain Terminals** — *strong, permanent, hermetic seal.*
- **Welded Steel Cases** — *durable, leakproof.*
- **Zinc Spray Finish** — *long life without painting or other maintenance.*

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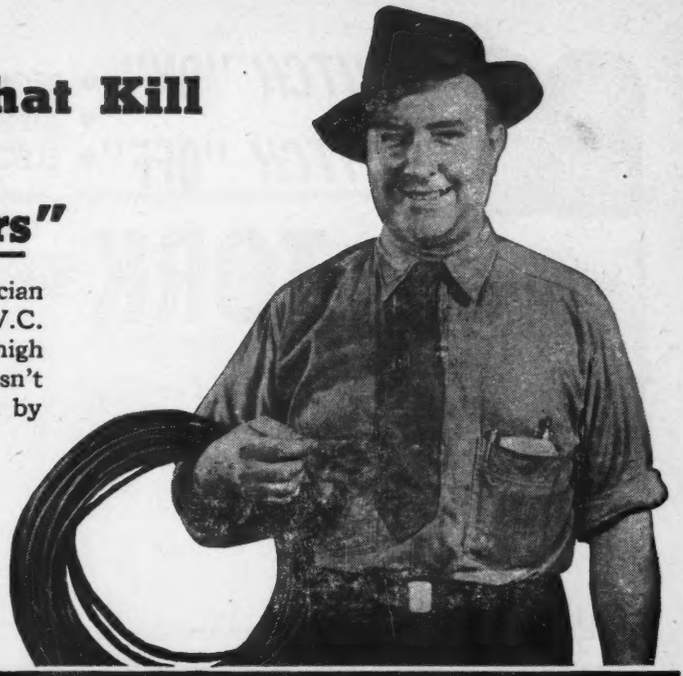
PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE
INERTEEN CAPACITORS

"Under Conditions That Kill Ordinary Wire Fast, This Wire Lasts Years"



Says Mr. T. F. Bannon (right) Chief Electrician at Bird & Son, "Rockbestos 600 Volt A.V.C. lighting wire withstands the baking heat and high humidity our conditions impose on it. It doesn't bake brittle, crack or flow. It isn't damaged by the constant condensation. In short, it lasts years longer under these rigid conditions than we could hope for with 'ordinary' wire. I've used Rockbestos A.V.C. for over 20 years... and it hasn't ever fallen down on a job for me yet! What electrician could ask for more?"

In the paper plant of Bird & Son, inc., East Walpole, Mass., temperatures in this paper machine dryer hood run a constant 135° to 140° F., with relative humidity often as high as 65%. Conditions like these mean a quick end for lighting wire not specifically engineered to do the toughest jobs as dependably as the easiest ones. Which is why more and more alert plant men are turning to Rockbestos for sure performance under exacting conditions.

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SWITCH "ON" • REGULARLY
• AUTOMATICALLY
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WITH A FAMOUS **TORK** TIME SWITCH
PLAIN OR ASTRONOMICAL

Tork Clock Time Switches are world renowned for their dependability and accuracy. They require no regular attention, and are available in many electrical capacities for both indoor and outdoor use.

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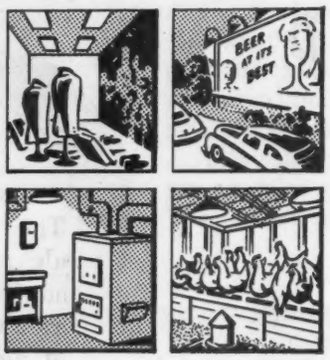
Send for free literature.



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Order from your wholesaler, or write today for sample bushing and prices.

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NEW LITERATURE

[FROM PAGE 192]

(32) LIGHTING PRICE LIST—Numerical index 60-A-4 lists all current prices on complete line of lighting equipment. Day-Brite Lighting Inc.

(33) MALLEABLE FITTINGS — Catalog 483 presents line of fittings for thin-wall conduit with data on couplings, connectors, entrance heads, straps, adapters. Wagner Malleable Products Co.

(34) RESIDENTIAL ELECTRIFICATION —Booklet B-3979 is 12-page presentation of Thrift, Budget, Ideal and De-Luxe electrification plans for home application. Plans include wiring, appliances, required service and circuits. Westinghouse Electric Corp.

(35) SELF-SYNCHRONOUS UNITS — Synchro units for indicating and remote control purposes, including control transformers, generators, differential motors and differential generators, are presented in two-color booklet. Arma Corp.

(36) LOW TORQUE SWITCHES—Data sheet 46 describes features of two low torque switches, including prices, characteristics, dimensions, applications and mounting methods. Micro Switch.

(37) SOLENOIDS — Small a-c high-power solenoids are the subject of bulletin SOL-2. B/W Controller Corp.

(38) INSULATION TESTER—Description, application and specifications of "Minor Megohmer is included in bulletin 450. Herman H. Sticht Co., Inc.

(39) WELDING ELECTRODES — Photographs, diagrams, electrode selector chart and complete details on full line of welding electrodes are contained in 50-page catalog. Wilson Welder and Metals Co., Inc.

(40) BATTERY CHARGERS — Bulletin 222 discusses multiple-circuit battery chargers with text, drawings, charts, Photos. The Electric Products Co.

(41) PLUG-IN STRIP — Standard lengths of redesigned multi-outlet plug-in strips for offices, stores, residences, shops and show windows is presented in 8-page Catalog CF-2. National Electric Products Corp.

(42) LIGHT STRIP—Data sheet 557 lists length, number of lamps, prices and other data pertaining to double row light strips, with and without reflectors, using 40-watt fluorescent lamps. Day-Brite Lighting, Inc.

In the News

Pension Fund Set Until End of '49

The Employees Benefit Agreement between the International Brotherhood of Electrical Workers and the IBEW Employers Section of the National Electrical Contractors Association will continue in effect, without change, until the end of 1949.

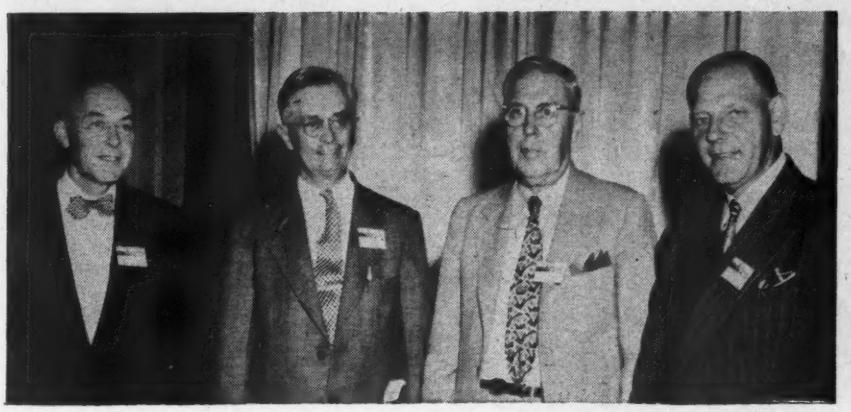
This was assured when the Oct. 1 deadline passed with neither side proposing any changes in the agreement that went into effect on May 5, 1947. In September, the IBEW convention at Atlantic City, through the leadership of President Dan W. Tracy, successfully squelched a number of proposals to raise the $50 monthly pension or lower the 65-year age requirement. The Employees Benefit Agreement supports the pensions on a matching basis.

Thus far, the plan is working well and is expected to continue solvent while employment remains at a high level. Both sides see possible danger ahead if business falls off. More IBEW members will go on pension. There will be fewer members on the payrolls to pay their 60 cents a month. And there will be smaller and fewer payrolls on which contractors will pay their 1 percent toward the pensions. In other words, the demand on the pension fund will increase while the contributions fall off.

Today, however, the pension plan stands well on all legs but one. Not all of the 9,500 electrical contractors employing IBEW members have joined in the plan. The latest figure is 7,061. It's going up steadily. Last March only 5,200 contractors were paying the 1 percent.

The number of contributing contractors will continue to increase as the IBEW puts more pressure on its local unions to refuse to sign a contract without including a provision for the pension payment. Membership in NECA is not necessary. NECA has only 2,300 members employing IBEW members, yet more than 7,000 contractors have joined in the plan.

The Pension Plan operates with two separate funds. One is a trust fund—IBEW Pension Benefit Trust Fund—set up under the rules of the Taft-Hartley Law and administered by a Board of Trustees consisting of public member Edwin E. Witte of the University of Wisconsin, Paul M. Geary, Executive Vice President of NECA, and J. Scott Milne, International Secretary of IBEW.



Western Section IAEI officers elected at recent Denver convention are: (L to R) First vice-president—W. J. Alcock, Chicago; president—W. C. Cale, Toronto, Canada; secretary-treasurer—F. H. Moore, Indianapolis; second vice-president—Otto E. Radtke, Cleveland, Ohio.

This fund is built up by the 1 percent of IBEW weekly gross payroll contributed by contractors to the National Electrical Benefit Board through 67 local boards. The Board consists of seven NECA and seven IBEW representatives and Dr. Witte. It makes payments to the trust fund quarterly. The last quarterly payment, made on October 1, brought the amount in the fund to $2,300,000.

Trustees had not yet begun to make pension payments from this fund in October. The IBEW had to make a technical change in its constitution at Atlantic City before the payments could begin. Exactly how the pensions would be paid from this fund—whether they would go only to employees of contractors—had not been determined when this was written.

The other fund is that accumulated by the IBEW from the 60 cents a month contributed by its participating members. The Union has complete control over this fund. The two are kept separate. Some pensioners will get their check from the contractors' Trust Fund and others from the IBEW Fund.

Under the benefit agreement, the Benefit Board may not turn into the trust fund more than the amount that has been collected by IBEW from its members since the beginning of the plan in May, 1947. The $2,300,000 kicked into the fund thus far is about $500,000 shy of matching the IBEW's collections, but it is expected that this deficiency will be wiped out as more contractors join up.

The number of IBEW pensioners increases steadily, as does the amount of pensions paid. Only 200,000 of the 450,000 union members participate in the pension plan by paying 60 cents monthly, and only about half of them are employed in the contracting industry. More than 3,000 get pensions. How many of these are employed by contractors is not known.

The IBEW pension plan began in 1927, with pensions of $40 a month at age 65 for members with 20 years good standing in IBEW. The participant paid 37 cents a month until the war years, when he was assessed an additional 70 cents a month for six months and 20 cents a month for 29 months until the 1946 convention. The assessments were necessary to bolster a sick fund. The 1946 convention ended the assessment, but raised the 37-cent monthly payment to 60 cents and the pension from $40 to $50. This took place after NECA had agreed to join in the plan.

Every year there are more pensioners on IBEW's rolls. There were 493 in 1935, 1,134 in 1940, 2,320 in 1945, and 2,980 last year.

Naturally, the amount of pensions paid has risen correspondingly: $229,400 in 1935, $525,500 in 1940, $1,033,900 in 1945, and $1,720,700 last year. In fact, as much money has been paid in pensions in the last five years as was paid in the 13 preceding years.

Currently, the IBEW is paying $160,000 a month in pensions and collecting only $150,000 from its members. There was $1,968,000 in the

SAVE TIME

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"PIPE MASTER"

Don't take OUR word for it —write for facsimile copies of letters sent to us voluntarily by owners of the Oster "PIPE MASTER". Those letters are PROOF that this modern pipe and bolt threading machine is a real investment *because it's a steady profit-maker!*

Standard range of the No. 502 "PIPE MASTER" is 1/4" to 2" pipe. Extra range 1/8" pipe. Equipped with special drive shaft you can thread pipe up to 6". Bolt range is 1/4" to 1 1/2".

Write for illustrated catalog "LIST 24-A".

THE OSTER MANUFACTURING CO.
2081 EAST 61st STREET
CLEVELAND 3, OHIO, U. S. A.

A trio of past-presidents at the Western Section, IAEI convention in Denver are: (L to R) J. B. Wilkinson, chief engineer, Fire Insurance Rating Bureau, Milwaukee, Wis.; Clifford Anderson, Oklahoma Inspection Bureau, Oklahoma City; John E. Wise, electrical engineer, Industrial Commission, Madison, Wisconsin.

IBEW pension fund on June 30. (The IBEW constitution permits a $1 assessment if the fund falls below $1,000,000.) On the same date, there was $1,400,000 in the contractors' trust fund, so the total amount available was $3,368,000. The third payment by the Benefit Board on Oct. 1 raised this another $900,000, making a total of about $4,268,000 available for pensions.

The IBEW sees plenty of potential trouble ahead. The average age of IBEW members paying toward pensions is rising. It was 35 when the pension plan began in 1927. Today it is almost 44 years. The average pensioner lives 12½ years on pension. The younger members just aren't joining up. Since they have to be IBEW members for 20 years and 65 years old to get pensions, most of them wait until they near 45 years old before joining the pension plan.

How to get the younger members to contribute toward the plan was the point of much discussion at the IBEW convention. Some locals suggested a graduated scale of pension beginning below $50 but running higher than that for those who participate for more than 20 years. The majority, however, did not want to undercut the $50 payment in any way.

There were other convention resolutions which would have increased the burden, such as by lowering the pension age and/or adding disability benefits. Many local unions, including Local 3 in New York, have their own disability benefit plans. All were rejected. Tracy's administration wanted no changes until the present plan was first made to work.

It was estimated that a reduction in the age requirement from 65 to 60 would cost an additional $4,000,000 a year. Disability benefits would add 30% to the current pension costs.

A depression is the biggest threat to the pension plan. As the convention law committee stated: "No one can safely estimate how much money will be paid by the contractors toward our pensions in depression times. In fact, we have no assurance that the Employees Benefit Agreement will even survive the test of depression." (The agreement can be terminated on 90 days notice prior to January 1 of any year.)

To put the plan on an actuarial basis, the committee pointed out, would impose an "utterly prohibitive" tax on the membership. It cited these actuarial estimates of what a $50 pension at age 65 would cost in annual payments, according to age when the payments were begun:

Age	Annual Payment
20	$ 7.38
25	15.44
30	29.94
35	53.63
40	89.94
45	145.81

The IBEW member now pays only $7.20 a year, and he can begin payments at age 45.

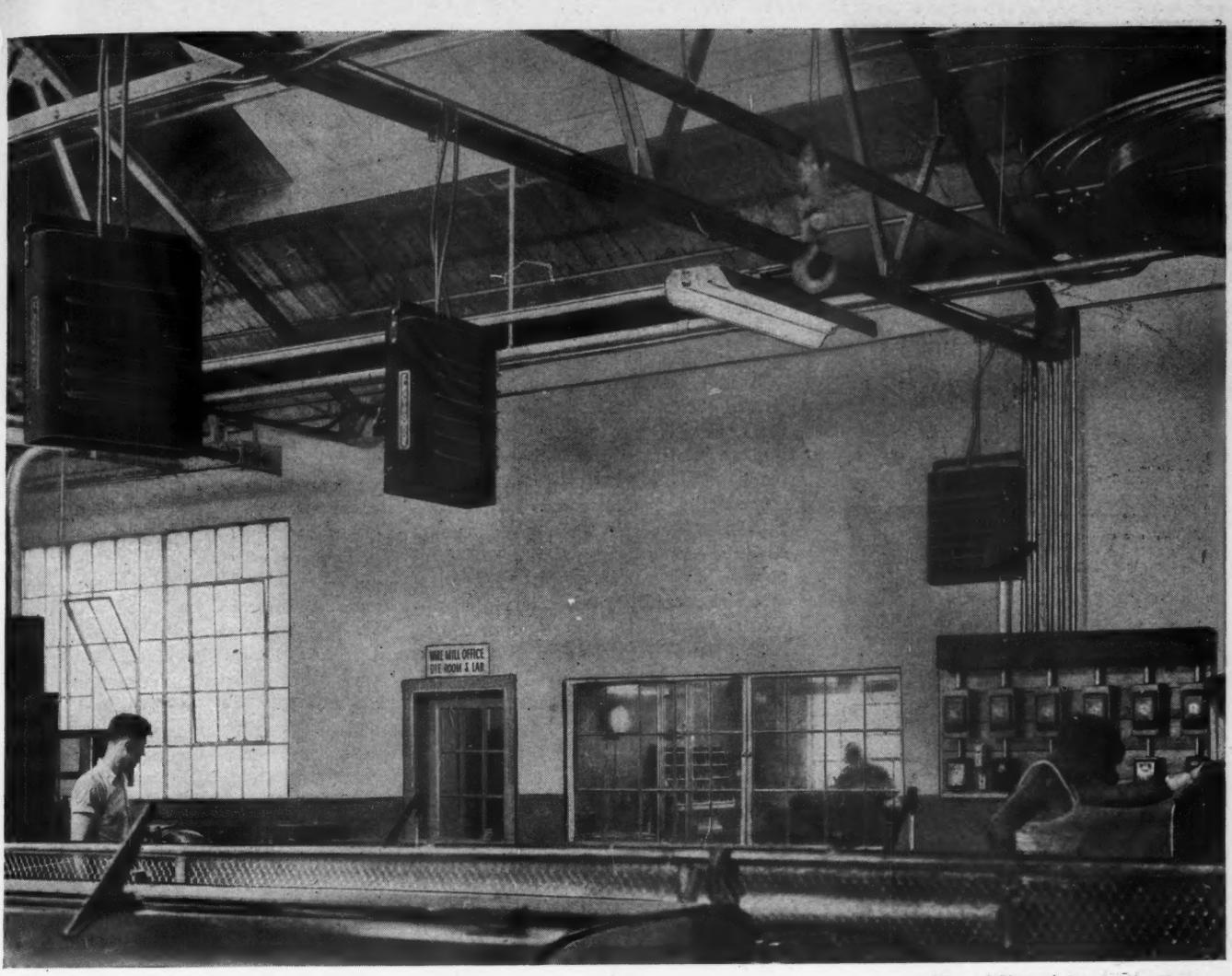
Illustrating the effect of depression on pay-as-you-go pensions, the convention's law committee cited, as an example, the Carpenters Union, whose $15 pensions were cut to $3 during the depression, and the Bricklayers Union, which cut pensions from $28 to $12. It said the Bricklayers will drop its pension payments after five years from now.

The IBEW looks at the past 12 years in trying to figure what its pension burden may be in the next five years. Each year, the number of pensioners has increased an average of 15.4% over the preceding year, and the pension payments have risen an average of 16.23%.

If that rate continues, the number on pension and the total pension payments will more than double between now and 1953, according to the IBEW pension department. Here are its estimates:

Year	No. on Pension	Payments
1948	3370	$2,000,000
1949	3899	2,324,000
1950	4499	2,700,000
1951	5142	3,140,000
1952	5934	3,650,000
1953	6848	4,242,000

Not all IBEW eligible for pensions are going on pension because of the high living costs and the availability of jobs. There are 3,000 on pension of about 4,861 who would be eligible for pensions as of next Jan. 1. If all of them took their pensions, the payments



Illustrated: Electromode Suspension Type Heaters

Only ELECTROMODE Can Give SAFE Electric Heat Anywhere In Your Plant

ELECTROMODE Unit Heaters have no exposed hot, glowing wires; thus they may be used safely *anywhere*. The patented Safety-Grid—a heating element insulated and embedded within a finned aluminum casting—supplies abundant fan-driven warmth. As auxiliary heat sources, Electromodes pay for themselves during changeable weather . . . give quick warmth *locally* while the main heating plant is shut down or banked. They save the cost of operating boilers when only certain departments need heat.

There are Electromodes for every industrial purpose—1.5 to 60 KW. Also portable and built-in heaters for home, office. Approved by Underwriters' Laboratories. We invite contractors to see their electrical wholesaler or write Electromode for further informaton.

Send for this new booklet on Industrial Heating, and Heating Analysis Form. Address Dept. EC-118.

Heavy-Duty Combination Portable and Suspension Type Heater. May be plugged in wherever heat is needed. Capacities: 3 to 7.5 KW.

1.5 KW Combination Portable and Suspension Type Heater. Light and compact, it is ideal for heating small areas such as guard houses, factory offices, etc.

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All-Electric **UNIT HEATERS**

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No matter how much you know about soldering, there's always a trick that will make it easier. This little 20-page pocket guide is crammed full of such time-and-trouble savers.

Without wasting words, it covers the whole soldering operation—points out DO's and DON'T's—refreshes your memory on difficult points—suggests methods that help you work faster. Yet there's no hard studying, no tough technical talk. Every word is plain everyday English and every point is made clear by easy-to-understand illustrations.

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When you send for your Guide to Easy Soldering, be sure to ask about the New Weller Soldering Guns. They're a handful of convenience, better from tip to grip.

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Enclosed find ten cents (10c) for which please send my copy of the Weller "Soldering Tips".

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would rise to more than $3,000,000 a year, compared with the $2,000,000 estimated for 1948.

Here is how IBEW sees the potential situation if the age requirement were lowered on Jan. 1:

At age 64, 5,638 would be eligible, costing $3,551,000 a year.

At age 63, 6,427 would be eligible, costing $4,049,000.

At age 62, 7,264 would be eligible, costing $4,576,000.

At age 61, 8,051 would be eligible, costing $5,072,000.

At age 60, 8,959 would be eligible, costing $5,644,000.

The employees Benefit Agreement doesn't limit the possible benefits to pensions alone. Provision is made for considering disability and hospitalization insurance and "such other benefits as are economically sound and will receive public acceptance." The first step, however, is the gathering of appropriate statistics on the number, age, health and employment records of IBEW members employed by electrical contractors. From these, actuarial studies will be made. This work has not yet begun.

Southeastern NISA Group Meets in Atlanta

Centralized motor repair and rewinding works will be faced with ever increasing competition from the large number of small shops which have been opened since the end of World War II. This is the opinion expressed by J. E. Jenkins, president of the Armature Winding Co., Charlotte, N. C., and president of the Southeastern chapter of the National Industrial Service Association.

Speaking at the opening of the annual meeting in Atlanta, Ga., Oct. 10-11, Mr. Jenkins pointed out that small local shops will go after local business, thereby saving customers on handling and freight to large shops in other centers. The tremendous increase in installation of electrical equipment in industrial plants offers expanded volume of business for motor service firms.

At the closing session the Southeastern chapter of NISA elected Howard A. Lilly, vice-president of Tampa Armature Works, new president to succeed Mr. Jenkins; Coleman Waldrop, manager of Wingfield & Hundley, Richmond, Va., vice-president; and Harold Laycock, Laycock Armature Works, Tampa, Fla., secretary-treasurer to succeed W. Hall Grey, manager of Southern Electric Service Co., Greenville, S. C.

Tampa was selected as the place for the 1949 convention.

The two morning sessions were given over to speeches and discussions while plant tours occupied the attention of the more than 175 registered delegates in the afternoon. Plants visited included General Electric, Westinghouse, Bearden - Thompson Electric Co., Cleveland Electric Co., Brownell Distributors, Inc., Insulation and Wire, Inc., and Potter and Rayfield, Inc.

Howard Stark, Citizens and Southern National Bank, urged the delegates to establish their credit rating at their banks and also to classify the credit rating of their customers. They were urged to take advantage of discounts when offered and to make credit a sales tool.

The advancement in the use of silicone varnishes and insulating materials has opened new possibilities in the opinion of C. A. Doremire, Dow Corning Corp., Midland, Mich. He said that several manufacturers are offering new lines of silicone insulated motors. Several large industrial concerns are using silicone in their own rewinding shop. Mr. Doremire recommended silicone insulation where motors have developed frequent failures.

Preliminary results of a survey of NISA members on a number of questions pertaining to their advertising programs were presented by Editor W. T. Stuart and Manager W. W. Garey of *Electrical Construction and Maintenance*. The survey revealed that about 96 percent of the shops did some advertising and most received tangible benefits. Many felt that they did too little advertising. Programs included direct mail, local newspaper, directories and some national media advertising.

Business will become more competitive in the future and NISA members were urged to make better use of advertising in sales. Such a program would include a study of advertising needs, selection of media and a budget in relation to sales volume.

Mr. Giles made a presentation of the NISA Code of Ethics and said that far-reaching benefits will accrue when they are followed.

A price squeeze was seen by H. E. Grant, treasurer of NISA, as the price of new motors declines. He urged members to increase repair and rewinding efficiency to meet this situation. Proper preparation, proper equipment and higher volume of business were given as possibilities of meeting the situation.

J. F. Steffner, Chattanooga (Tenn.) Armature Works, said that better materials handling equipment will do much to lower shop operating costs. He saw this as a necessity in many instances.

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RESISTS . . . ozone, wear, sunlight, water, chemicals and most other normally destructive factors.

GIVES YOU . . . 14 colors including NEMA standards.

PROVIDES . . . more conductors for a given space.

HAS . . . excellent electrical properties.

IS . . . easy to draw, easy to strip. And is light in weight.

Wire and cable insulation made from Geon polyvinyl resins is suitable for industrial, manufacturing and utilities wiring. Where the best wire and cable insulation is required, specify Geon by name. For information regarding special applications, write B. F. Goodrich Chemical Company, Department H-11, Rose Building, Cleveland 15, Ohio. In Canada, Kitchener, Ont.

B. F. Goodrich Chemical Company

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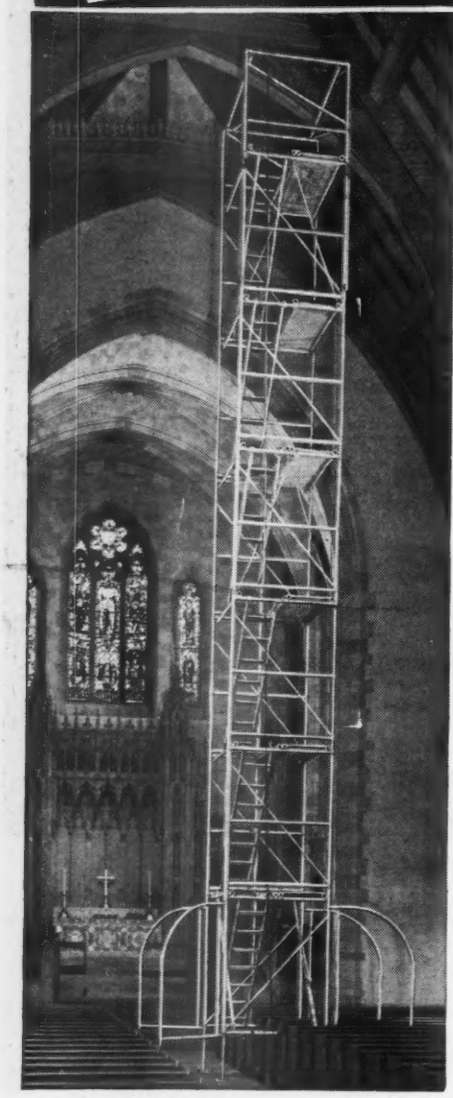
NEW!
Aluminum-Alloy
"UP-RIGHT"
SCAFFOLDS
MOBILE 45' UNIT TAKES ONLY 15 MINUTES TO ERECT



Electrical work by Interstate Electric Co. in Trinity Church, Springfield, Massachusetts.

Rolled easily from position to position. Bridges obstacles with ease. A 7 foot, single section unit requires one man only a minute to erect; a 45 foot multiple unit only 15 minutes. Stronger than structural steel yet one-third the weight. Safety-tread stairway completely within the structure. No wrenches, wing nuts, bolts, loose parts. Each section folds flat.

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BERKELEY, CALIFORNIA
Offices in All Principal Cities

NLRB Enjoins Oak Ridge Maintenance Stoppage

A secondary boycott aimed at the Kiser Electric Co. of Knoxville, Tenn., has been enjoined under the Taft-Hartley labor law by Federal District Judge George C. Taylor.

The injunction forced IBEW Local 760 to end a six-week stoppage of work by 100 maintenance electricians on the atomic reservation at Oak Ridge.

The electricians are employed by Roane-Anderson Co., which operates Oak Ridge utilities for the Atomic Energy Commission. They quit work July 30 after Roane-Anderson let a subcontract for a new school lighting system to Kiser Electric Co., which NLRB says does not employ union labor.

Roane-Anderson filed secondary boycott charges against Local 760 with NLRB, accusing the union of inducing the men to quit work in violation of their contract.

Based on these charges, NLRB issued a formal complaint against the local and obtained the injunction, which will remain in effect until the charges are disposed of by NLRB.

Local 760 denied the charges, contending that the men quit work individually and voluntarily.

In rejecting the union contention, Judge Taylor held that statements of Local 760 to its members had the effect of strike directives, even though no formal strike was called. This is the same view taken by Federal Judge T. Alan Goldsborough last winter in holding John L. Lewis, president of the United Mine Workers, guilty of contempt of court for refusing to obey a court injunction to order the miners back to work. Lewis is appealing this conviction, which resulted in a $20,000 fine against him and a $1,400,000 fine against his union.

League Leaders Meet In Washington

Adequate wiring, electrical appliances and a wide range of industry prospects and plans were discussed at the thirteenth annual conference of the International Association of Electric Leagues in Washington, September 29-October 2nd. Theme of the conference was "pioneering new frontiers of electrical service". Various aspects of these frontiers were explored in a succession of talks, reports and discussions.

The program, prepared by a committee headed by A. H. Kessler, North Central Electrical Industries, started with a welcome by J. S. Bartlet of Potomac Electric Power Company, followed by IAEL President S. E. Strunk. The future course of Adequate Wiring promotion was explored by T. J. Newcomb, of Westinghouse, Chairman of the executive committee of the National Adequate Wiring Bureau. C. H. Christine, St. Louis Electrical Board of Trade followed with a demonstration of a method of local promotion for selling certified wiring systems to the public.

Talks and demonstrations on appliance sales and marketing were presented by H. R. Roberts, Whiting Corporation, A. P. McNamee, McCall's magazine, and A. W. Peterson, Hotpoint. F. W. McChesney, General Electric, presented a program of action for more efficient electrical utilization in industry.

Election of Board of Governors and officers for the year 1949 resulted in the following:

President: J. Clark Chamberlain, Secretary-Manager, Bureau of Radio & Electrical Appliances, of San Diego County; Vice President: A. H. Kessler, Manager North Central Electrical Industries, Minneapolis, Minn; and

Officers of Northwestern Section IAEI elected at Salt Lake City meeting—(Left to right) W. L. Gaffney, D. J. Walters, A. E. Dickey, Ralph Grant, president, J. Hyde Stayner, and L. W. Carlisle, past president.

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POWERSTAT Dimmers — dimming, brightening or blending light — can help create the proper mood. In stores, it makes merchandise more appealing, keeps personnel alert and cordial. In hotels, the air of luxurious living and fine service is enhanced by proper lighting treatment. In cocktail lounges and restaurants, changing light treatment adds profitable dollars to beverage and food checks — increases clientele and promotes repeat business.

The art of using light to create desired effects and moods stems from the theatre, where POWERSTAT Dimmers give smooth, precise control. In churches, the judicious use of light — controlled by POWERSTAT Dimmers — can intensify the atmosphere of dignity and reverence. And school auditoriums, gymnasiums and play stages, made more interesting through POWERSTAT Lighting Control, increase rental revenue and frequency with this modern economical equipment.

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POWERSTAT Dimmers, versatile in application, *steplessly* dim any number of lamps up to rated load from complete black-out to full-on. They dim by transformer action without heat loss — handle incandescent or cold-cathode installations with equal economy, efficiency and precision.

Designed for manual or motor-driven operation, for direct or remote control, POWERSTAT Dimmers are available in numerous standard units to meet your specific requirements.

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It has 5 Safety Features

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Well built and shock-proof in a LAMINATED bakelite housing, the Knopp Voltage Tester tells immediately and simply if circuit is open or closed; magnitude of voltage between 110 and 600; a-c or d-c, pure or rectified; 25 or 60 cycles—for testing old and new circuits, fuses, locating grounds, etc.

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ELECTRICAL FACILITIES INC.

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J. Clark Chamberlain was elected president of the International Association of Electrical Leagues.

Treasurer: H. P. Wilson, Secretary-Manager, Electrical Institute of the Tri-Cities, Rock Island, Ill.

The Board of Governors for 1949 includes these men and in addition—P. L. Heath, Manager, Electric League of Western Pennsylvania, Pittsburgh, Pa.; J. G. Waddell, Managing Director, Electric Institute of Boston, Inc.; C. G. Odell, Executive Secretary Electrical Association of Detroit; R. B. Hubbard, Secretary-Manager, Rocky Mountain Electrical League, Denver, Col.; C. W. Stone, Manager, Intermountain Electrical Association, Salt Lake City, Utah; G. W. Austen, Secretary-Manager, Electric Service League of Ontario, Inc.

Retiring president S. E. Strunk will serve as advisory member of the Board. O. C. Small, Manager of Business Development Department of NEMA, and J. F. Biggi, also of NEMA, were re-appointed secretary and assistant secretary, respectively.

Chicago Journeymen Under Seniority Plan

Construction trades in the Chicago area are watching the local electrical construction industry with considerable interest. Reason: For the first time in the history of the inside electrical construction field, and reportedly the first time in any of the building trades, a seniority system has been applied to the hiring and firing of Class A journeymen electricians.

The Union hiring hall no longer exists. Contractors are adjusting their operations to the new method of having journeymen assigned to them by an impartial Administrator strictly on the basis of *established seniority in the trade* (date of electrician's first employment as a Class A journeyman) and specific skills.

Layoff is still in the hands of individual contractors and employers but is controlled by the man's established seniority in the trade and his *shop seniority* (length of service in the shop) with the individual contractor.

Known as the Seniority System of the Electrical Joint Arbitration Board, the new plan was established April 2, 1948 by the Electrical Contractors Association of City of Chicago and Local 134, International Brotherhood of Electrical Workers (AFL). It is in the form of an addendum to the agreement of August 26, 1921 (and all previous agreements since August 11, 1903) between the two groups. It became operative July 15, 1948 and affects all participating employers and their Class A journeymen employees working within Cook County, Illinois and doing "inside electrical construction work", all construction work except pole line and transformer work on public property or direct utility work.

Devised to function in the common interest of the public, employer and employee, the system was designed (1) to give a reasonable measure of protection to earning opportunities of employees having greater established seniority; (2) to assure an adequate pool of fully trained men readily available to employers; and (3) to prevent serious loss of the more skilled craftsmen from the trade during repeated long periods of unemployment.

Card files have been compiled of some 7,000 Class A journeymen electricians who work for 800 employers in Cook County, Illinois. Included in the file data are the man's skills and abilities and the date of his first employment on Class A work for a contractor working under the original agreement (1903) or one who later came under the agreement. This date determines the journeyman's *established seniority* status in the trade and hence his job priority.

To become eligible under the System, a journeyman must have worked for at least six months with an individual employer (as of May 1, 1948). Others are placed on a probationary basis for this period to determine if they possess the skills and efficiency required of a fully trained journeyman. Once eligible, a man's seniority dates back to his first day on Class A work.

Apprentices come under the System only when they have completed their apprenticeship training under the agreement terms and have transferred to journeyman status. The regulations of the Electrical Joint Apprenticeship and Training Committee must still be met.

ILLINOIS PORCELAIN WIREHOLDER INSULATORS MAKE

Safe Service Connections

Smooth, rounded surfaces protect wire insulation. Deep, sharp screw threads assure easy and firm installation. Non-shrinking metal alloy keeps screws permanently fastened to insulators. Special galvanizing process protects all-steel screws with smooth, even coating. No rust streaks on sides of buildings. These dry process wireholders available in sufficient styles and sizes to meet all requirements. Wet process porcelain supplied on special order.

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KNOBS—Firm grip knobs that don't chip when installed. Cement coated, extra length nail—genuine leather washer — code standard. Wide variety of heights, diameters, holes and grooves.

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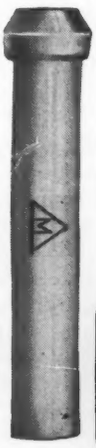
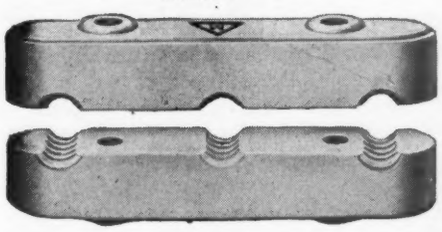
TUBES—Glazed, unglazed, split, floor, split floor, headless, curved, crossover split, and crossover. Uniform inside and outside diameters. Sizes ½ to 48" long, 5/16 to 3" diameter.





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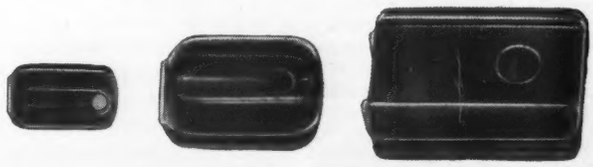

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. . . from blueprint to sample in 3 days!

Unusual wiring problem required a special connector never before developed. These rigid specifications had to be followed:

Connect two 2/0 flexible cables and one 2/0 flexible cable, end to end . . . carry 300 amperes at 12 volts with negligible voltage drop . . . withstand extreme vibration without loosening . . . design connector so that a vapor-tight insulating support could be molded around connector body.

FRANKEL engineering quickly solved this difficult problem. The connector shown above was accepted after testing for voltage drop and vibration.

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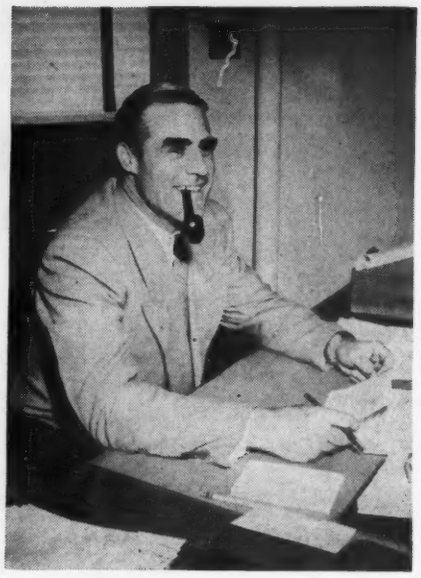
42 YEARS OF KNOW-HOW IN SOLDERLESS CONNECTORS



Dr. Herbert Blumer, Administrator of the Seniority System for Chicago journeymen electricians.

A System Administrator maintains five separate files: (1) a list of all participating employers; (2) a seniority list of all journeymen with established seniority; (3) a seniority list of unemployed journeymen who report to the administrator; (4) a list of all journeymen working under the probationary provisions; and (5) a list of all apprentices working under the agreement and names of their employers.

When a contractor needs men, he calls the administrator's office specifying the number of men and specific skills he requires. The administrator assigns men from his unemployed seniority list, men with highest seniority having first call. However, should the top priority men lack the skills required, a man lower on the list, but with those skills, will be assigned. If no qualified men are on the unemployed seniority list, the contractor can seek men elsewhere. The administrator will, upon request, furnish the contractor with names of qualified unemployed probationary workers or other men (non-union) who are on the administrator's unemployed list.

A contractor need not accept an assigned journeyman if that man does not possess the skills he professed, or if that man had previously quit the contractor while working under the System. A journeyman can refuse an assignment for a cause without jeopardizing his established seniority status. In such cases, the next man on the unemployed seniority list gets the assignment.

Contractors and employers still control layoff, but must follow seniority status. In general, the following order of layoff is the rule: First, probationary workers; then journeymen in the inverse order of their established seniority in the trade. Workers currently employed as foremen are exempt from the seniority order on layoff, as are shop stewards except where less than three men are employed.

To prevent "bumping" of long-term employees with lesser established seniority (use of seniority status to displace low-seniority men), *shop seniority* comes into the picture during layoff. Men with higher *established seniority* but with less than 30 days of service with a contractor cannot displace men with lower seniority having longer service with that specific employer. To establish employment preference over long-term employees (three or more years service with a single contractor) of lesser established seniority, a journeyman with high seniority status must work at least six months with that specific employer. Contractors need not lay off more than 50 percent of current employees with more than three years service at any time, except as required by decreasing work demands. Again, low-seniority employees with specific essential skills can be retained over high-seniority journeymen lacking those skills.

Administration of the Seniority System is in the hands of an Administrator appointed by a Joint Arbitration Board composed of five members each of the Electrical Contractors Association of City of Chicago and Local 134, IBEW.

The Joint Board appointed Dr. Herbert Blumer, professor of sociology at the University of Chicago since 1928, as impartial administrator of the System. Dr. Blumer has held important posts in labor arbitration circles for some six years. His foremost position was Chairman of the Board of the United States Steel Corporation and the United Steel Workers Union (CIO) covering some 200,000 employees in the basic steel industries. Prior to that, he was Permanent Arbitrator for Armour & Company and the United Packing House Workers of America (CIO). Just before taking his present post, Dr. Blumer was Contract Arbitrator (on a national basis) for International Harvester and the United Farm Equipment Workers (CIO).

Based on his experiences in labor relations, Dr. Blumer carries a firm conviction that a seniority plan is practicable in the construction trades.

The Administrator has the responsibility of arbitrating any disputes that may arise between a worker and his employer concerning interpretation and/or application of provisions of the Seniority System. Should the disputants take issue with Dr. Blumer's decision, either party has the right of

RELIABLE REMOTE CONTROL AT LOW COST...WITH

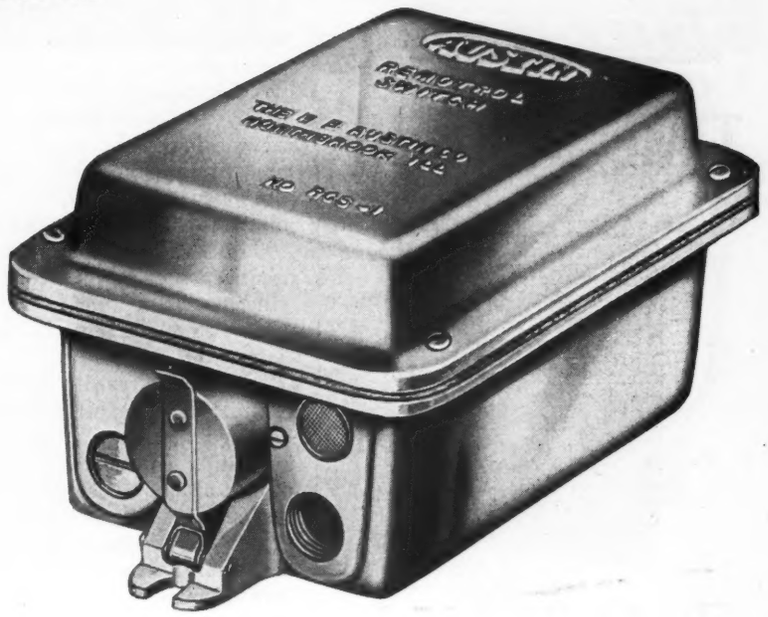
AUSTIN REMOTROL

REMOTE CONTROL SWITCH FOR YARDLIGHTS, MACHINES, PUMPS, MOTORS, ETC.

SAVES WIRE AND WIRING COSTS—ELIMINATES THE NEED FOR COSTLY 3-WAY AND 4-WAY SWITCHES—ALLOWS THE USE OF *ANY DESIRED NUMBER* OF MOMENTARY CONTACT SWITCHES.

$13.50 EACH INCLUDING TWO DESPARD MOMENTARY CONTACT SWITCHES

TERMS: 2% CASH 10 DAYS, NET 30 DAYS; F.O.B. NORTHBROOK, ILLINOIS. FREIGHT ALLOWED ON 100 LB. SHIPMENTS.



RUGGEDLY BUILT FOR LONG YEARS OF TROUBLE-FREE SERVICE

Remotrol is a thoroughly reliable remote control switch designed for indoor or outdoor operation of lighting circuits, small motor circuits, etc., where economy and convenience of operation are demanded. Built to the highest engineering standards, the unit is mounted on a bakelite panel and is equipped with large terminals having 19/32 binder head screws, and housed in a heavy cast aluminum weather-proof case. The case is designed with two heavy, slotted external lugs for easy mounting, and a drain hole, screened for protection, is provided for drainage of excessive condensation. Four ½" tapped holes, two open and two plugged are furnished for flexibility of installation. In actual tests Remotrol has operated successfully at temperatures as low as 60 F. below zero. To safeguard against overload the unit carries a replaceable 15 amp. Fustat protected by a spring-hinged cover.

AUSTIN CAT. No.	AMPS.	VOLTS	CYCLES AND CURRENT	DIMENSIONS			APPROX. WT. LBS. EA.
				HEIGHT	WIDTH	DEPTH	
RCS-1	15	115	60 c., AC	8½"	6"	4"	4

CIRCUIT

The circuit carries 15 amps. of current at 115 volts, 60 cycles, AC and is designed to accommodate any number of momentary contact switches connected in parallel, using only two wires. In some applications (operation of farm yard lights, well pumps, etc.) one side is connected to switch and the other side to ground.

HOW REMOTROL OPERATES:

The Remotrol unit consists of a solenoid plunger-type ratchet switch which is energized by operating a momentary contact switch. This action indexes the switch mechanism to complete the circuit. Circuit remains on, even though solenoid is not energized, until one of the momentary contact switches is again operated. Having become energized once more, solenoid moves the ratchet and breaks the circuit. The powerful solenoid, phosphor-bronze blades and silver-faced contacts give the Remotrol circuit a quick, positive make-break action.

WIRING INSTRUCTIONS FURNISHED WITH EACH UNIT

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INTER-MATIC

TIME SWITCH

Top Quality!

- 35 Amperes
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Lowest Price!

- No time switch with similar specifications sells at so low a price
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Write for FREE supply of sales folders and name of nearest distributor.

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INTER-MATIC
TIME SWITCH

appeal to the Joint Arbitration Board. Members of this 10-man Board (five contractors, five IBEW men) are: Contractor Representatives — O. F. Burnett, Jr., J. N. Pierce, L. W. Johnson, A. C. McWilliams, and J. M. Hoffman; Local 134, IBEW Representatives—Charles M. Paulson, John H. Murphy, Harry Hughes, Joseph Flynn and F. Dobert. J. Walter Collins is secretary of the Board.

Reports indicate that the system is working smoothly. During the first two months of operation, over 250 requests for journeymen were filled and over 500 men placed on jobs. Approximately 100 probationary journeymen are waiting to be placed and several hundred non-union electricians possessing journeyman skills are on the administrator's list. In addition to the 7,000 Class A journeymen, 760 apprentices are on file. Many of these will come under the Seniority System when they transfer to journeyman status.

Spot checks reveal that the system is eliminating labor pirating and that the smaller contractors feel they are getting a break with the impartial assignment of men to fill requests as they come into the administrator's office. To date, gripes have been relatively few. The real test will come if construction work turns down and established seniority begins to assert itself in the form of employment preference.

Several other electrical contractor organizations in the midwest area are studying the Chicago plan and weighing the possibility of establishing a system of their own. Other building trade groups are viewing the system with considerable interest and waiting to see what happens before devising a similar plan for their own organizations.

IAEI Holds Section Meetings

The annual round of Section meetings of the International Association of Electrical Inspectors got under way with the Western Section convening at the Cosmopolitan Hotel in Denver, Colorado, Sept. 13–15 inclusive. Following in succession were meetings of the Northwestern Section at Salt Lake City, Utah; Southwestern, Oakland, Calif.; Eastern, Atlantic City, N. J.; and the Southern at Jackson, Miss., on Oct. 18–20. All sections devoted a substantial portion of their programs to a discussion of the 1947 National Electrical Code, its interpretation, possibilities of the future changes and a general exchange of field problems encountered by inspectors in their respective areas. Technical subject presentations completed the agenda.

Making the circuit of fall section meetings of the International Association of Electrical Inspectors are secretary-treasurer, Charles L. Smith (left), Chicago; and president Jack G. Fisher of Jackson, Mississippi.

Two new members of the International official family—J. G. Fisher, president, and Charles L. Smith, secretary-treasurer—made the circuit of Section meetings. In his president's address, Mr. Fisher paid tribute to the late Vic Tousley's services to the IAEI and contributions to the inspection field; revealed that at this 20th Anniversary, IAEI has a membership of 7,000 (Western Section, 2,135) men who are either installing, supervising or inspecting electrical installations; pointed out the value of IAEI programs and activities to the protection of life and property.

President Fisher believes that the IAEI can effectively expand its activities to be of more help to the electrical industry in smaller municipalities. To this end he suggested that:

1. Membership of rural and small town electricians, as Class A Associates, be encouraged as a means to promoting safer wiring standards in these areas.

2. Regular News Bulletin publication of articles on Code rules of especial interest to the small town inspector and electrician.

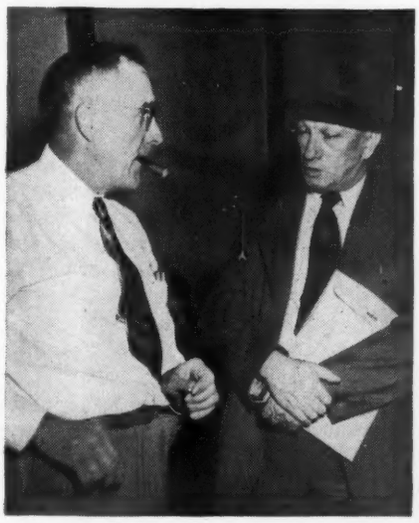
3. Publication of a separate Code edition for small municipalities (similar to present NFPA building code for small towns) to include only Code rules applicable to average wiring installations in those areas.

International secretary-treasurer Charles L. Smith briefly outlined the procedure for making Code revisions under the newly organized Electrical Section of the National Fire Protection Association (replaces the former Electrical Committee). The Electri-

cal Section has a National Electrical Code Committee which consists of a Correlating Committee and numerous Code-Making Panels. Proposed Code revisions are referred to the respective Code-Making Panel for study and recommendations. The Correlating Committee reviews all reports of the Code-Making Panels and reports to the Electrical Section, NFPA on its recommendations concerning Code changes. The Section then reports to the National Fire Protection Association, at its annual meeting, concerning revisions of the Code which have been proposed by the National Electrical Code Committee.

Supplementary revisions of the National Electrical Code, to be made annually as a result of reports from one or more Code-Making Panels, may receive further consideration when a General Code Revision is made every four or five years.

Members attending the 44th Annual Western Section meeting in Denver heard Section president R.C Loughead of Detroit take issue with the apparent practice of using the N.E.C. as a *minimum* standard and not providing for future needs—particularly in new home wiring. Mr. Loughead also rapped individual municipal contractor licensing practices requiring large license fees in each town where contractors operate. Loughead's remedy would be a reciprocal arrangement whereby the contractor would be licensed where his headquarters are located and would pay a $1.00 registration fee in other localities. Such a plan is now in operation among 20 municipalities within a 50 mile radius of Detroit, he reported. Loughead would like to see more of this district-wise and at a State level, if a State Licensing Law exists.



Electrical contractor Spencer Smith (left) of Larned, Kansas, swaps wiring experiences with chief electrical inspector William H. Hart of Pueblo, Colorado.

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QUICKLY INSTALLED
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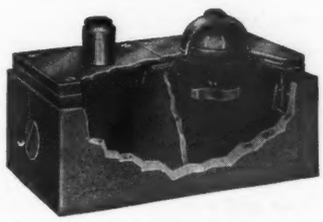
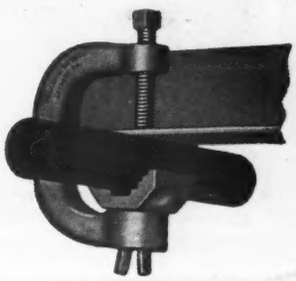
"Latrobe" Floor Boxes and Wiring Specialties are swiftly and easily installed because they are kept simple.

They give smooth, trouble-free service because they are made of finest materials.



No. 252-R Two Gang Box With #206-207 Nozzle

Adjustable—with No. 208 Receptacle in one section. One Cover Plate has ½" Flush Brass Plug; other has 2" Flush Brass Plug.



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10 Amp. 250 Volt Receptacle in Brass Housing, mounted on ½" brass pipe extension 3" long—longer extension available if desired.

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Simple and compact in design the No. 110 Non-Adjustable Watertight Floor Box is quick to install and gives trouble-free service. 208 Receptacle. Cover Plate 3½" diam.

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No. 150 Box — No. 207 Nozzle

An adjustable, watertight box for installation in concrete or wood finished concrete floors. Furnished with 4¼" Cover Plate #242 and large Adjusting Ring #215.

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THE AMAZINGLY VERSATILE—MODEL 40

UTILITY TESTER

A NEW KIND OF INSTRUMENT FOR TESTING ALL ELECTRICAL CIRCUITS AND UTILITIES

- Thermostats
- Lamps
- Tubes
- Fluorescents
- All Fuses
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THE MODEL 40 ALSO TESTS ALL MOTORS Single - phase, multi-phase, universal, squirrel cage, induction, in fact every type of motor from fractional H.P. to 2 H.P.

THE MODEL 40 UTILITY TESTER

Will indicate whether voltage is 110 Volts or 220 Volts, if current is A.C. or D.C. and if frequency is 25 cycles or 60 cycles. Will test Thermostats under actual working conditions. Will measure the actual current consumption of any appliance either A.C. or D.C. while the unit is in operation—reading will be direct in amperes—the appliance or utility may be plugged directly into front panel receptacle—a special pair of insulated clip-end leads is provided for motors. Incorporates an ultra-sensitive direct reading resistance range which will accurately measure all appliance and utility resistances down to a fraction of an ohm. Will test bulbs, fuses, condensers, field coils, etc. Is ideal trouble shooter as it will instantly locate opens, shorts and grounds. Will locate cause of failure in three-way heat control switches. Will indicate when one side of an appliance or motor connected to line under test is "grounded." Will indicate excessive leakage between a motor and a line. Will indicate when a three-phase motor is running erratically due to a "blown" fuse.

Model 40 Utility Tester comes housed in a rugged crackle finished steel cabinet with portable cover.

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Complete with all test leads and operating instructions

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With toe release hook which returns automatically to the starting position by simply touching the release arm with the toe after conduit is formed. The only bender which can be released from conduit with very little effort. Will be in stock about January 2nd, 1949.

Cat. No. 226

NOW IN STOCK

Thinwall single duty benders with automatic toe release hooks.

CAT. NO.	SIZE
221	½"
224	¾"
1223	1"

SHORT RADIUS ½" THINWALL BENDER

In stock about January 2nd, 1949

Cat. No. 225

Lew Electric Fittings Co.

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A. H. Welklin, chief electrical inspector, Fort Wayne, Ind., and Carl E. Evans (right) field engineer, Grain Dealers National Mutual Fire Insurance Co., Danville, Ill., swap experiences at Denver IAEI meeting.

Many inspectors are in favor of Civil Service plans in their field and want the protection and retirement advantages included, reported John E. Wise, Madison, Wisconsin. He also suggested observance of an annual "electrical safety" week to emphasize the importance of safe electrical installation and maintenance practices.

Considerable progress in the new electrical cord labeling program was reported at the meetings by Howard W. Kelsey, Director, Safe Electrical Cord Program, NEMA. A large number of cord sets and power supply cords with the new UL "flag" label—covering plug and assembly, as well as the cord—will soon be on the market, he advised. A comprehensive mailing campaign promoting the use of safe cord sets will start in January.

Surprisingly few code changes were suggested at the Section meetings west of the Mississippi. The Western Section discussed the need for code revision regarding emergency lighting, especially for hospitals and places of public assembly; asked again that Type S. fuses be made mandatory in the Code. The Northwestern Section felt that the six-sub-divisions-of-load rule should be amended to require a single disconnecting means ahead of such switches or breakers in theaters, schools, and place of public assembly; discussed sales control problems.

At the Southwestern Section requirements for interrupting capacity in entrance circuit-breaker equipment sufficient to interrupt the amperage and voltage characteristics of the supply network ahead of it were asked of the code revision committees. Reported pressure from neon sign contractors to employ outside outline lighting standards to neon or high voltage tub-

ing installations for interior illumination precipitated a recommendation that the code be clarified to specify outline lighting as for exterior use. Questions on low voltage relay control systems for interior lighting were answered by H. H. Watson, General Electric Co., Bridgeport, in a paper presented at the various meetings.

Technical discussions

Future Underwriters listings of Approved Electrical Appliances, Equipment and Wiring Accessories will be in two parts—one exclusively devoted to equipment for hazardous locations, Curtis Welburn, president of Underwriters' Laboratories, Inc. advised the Sections after polling their preferences.

In the future, all switchboards made by the Frank Adam Electric Co., St. Louis, will carry an Underwriters' label, according to Floyd Green, chief engineer.

The factory-sealed explosion-proof switches are available for installation in existing hospital operating room wiring systems, reported R. P. Northup, Crouse-Hinds Co., Syracuse, N. Y. Mr. Northup outlined the application of electrical equipment to operating rooms, the segregation of wiring from other systems by a one-to-one insulating transformer; revealed the possibility of a request by the American Hospital Association for NFPA to lower the hazardous "ceiling height" in operting rooms to eliminate the need for expensive explosion-proof surgical lighting equipment.

A contractors comment on the Code was presented by George Andrae, president, Herman Andrae Electric Co., Milwaukee. Andrae again made a plea for a "single-column" standardized and simplified wire table; wants

William T. Van Arsdol (left) and L. D. Straight are chief electrical inspectors in their respective municipalities of Denison and Woodbine, Iowa.

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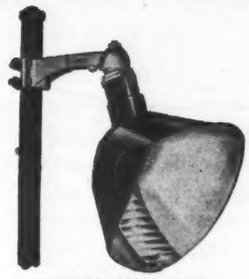
ANGLE REFLECTORS FOR SIGNS



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POST TOP OR PUMP ISLAND REFLECTORS

Quad Units are easily wired and installed, quickly detachable for cleaning. This complete line provides the correct unit for most outdoor lighting requirements. Each unit is highly flexible in design, fully weatherproof and the porcelain finish is permanent.

Rely on QUAD for thoroughly modern installations whether Angle Reflectors for signs—Floodlights for area lighting or Post Top or Pump Island Reflectors.

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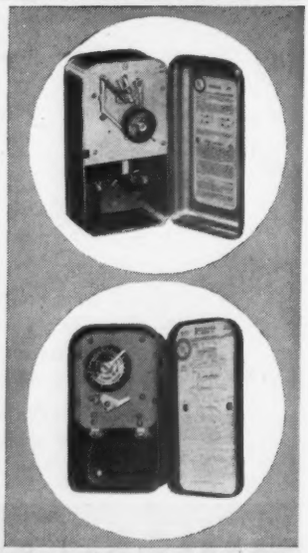


RELIANCE TIME SWITCHES

Chief electrical inspectors Roy H. Rist (left), Davis, South Dakota, and Carl L. Ramsby, Goshen, Indiana, watch H. H. Watson demonstrate General Electric's new low-voltage remote-control wiring system.

standardized use of Code table motor current values (when nameplate ratings are not known) to put estimating on an equal basis; suggested use of Type SB (slow-burning) wire between fixtures and conduits where temperature is above 60 degrees Centigrade; wants manufacturers to make a standardized heavy-duty service-entrance bus duct to eliminate multiple conduits and paralleled conductors.

S. J. Rosch, manager, insulated products development, Anaconda Wire and Cable Co., gave Andrae one of the answers he is seeking. Rosch's predictions, based on laboratory developments, are that two insulated conductors will eventually replace all those now used for building wiring. One, with a butyl rubber insulation, will cover all applications in the 60 degree to 80 degree Centrigrade range; the other, with a silicone rubber insulation, will be used for higher temperature applications up to 200 degrees Centigrade. Polyethylene can now be combined with butyl rubber to give outstanding electrical properties and with another material to make it flame, melt, and drip-proof, Rosch revealed. For more than nine conductors in a raceway, he gave the following rule: 60 percent rated current carrying capacity for 10 to 15 conductors per raceway; 50 percent capacity for 15 or more. Rosch discussed conductor insulations and HF corona discharge at the other meetings.

Application and installation of U. S. Rubber Company's new Uskon electric radiant heating system (conductive rubber ceiling panels) was reviewed by Howard Weber, sales manager of U. S. Rubber's wire and cable department. The same subject was covered by J. H. Stumph, chief engineer, Pacific Coast Division, U. S. Rubber Co., at the Salt Lake City and Oakland meetings. Uskon's advantages in comfort, health and architectural appearance were listed. Test installations are now being made in different sec-

tions of the country to determine the economic advantages in various degree-day areas, Weber added indicating that it takes about 12 kilowatts of connected load to heat an average 5-room house.

Robert A. Reardon, sales engineer, Bussman Mfg. Co., demonstrated the double protection (thermal overload and short circuit) afforded by dual-element Fusetrons. Their tremendous time lag takes normal motor starting current surges and harmless overloads, but protects on heavy sustained overloads, Reardon asserted as he demonstrated their advantages over conventional fuses. Such time-lag and overload features permit installation of smaller fused switches on motor circuits and give single-phasing protection while still providing the short circuit protection of ordinary fuses.

A new book "Steel Electrical Raceways", covering application and installation of steel raceways for electrical systems will soon be off the presses according to Walter O. Zervas, research engineer, American Iron & Steel Institute.

Power factor and its correction were discussed at three of the Section meetings by R. D. Allsop, R. K. Collins and J. L. Wagoner, all of Westinghouse Corporation. J. J. Siddall, H. H. Robertson Co, Pittsburgh addressed a similar number of Section meetings.

Static Grounding (G. M. Kintz, Bureau of Mines, U. S. Dept. of Interior) and Industrial Control (E. H. Alexander, G. E. Co.) were on the technical subject agenda at the Southern Section conference.

At the Eastern Section conference, members heard discussion on Electrical Inspection of Oil Burners (Herbert Witte, Underwriters' Laboratories); Prevention of Hazards of Television Receivers and Antennae (K. S. Geiges, Underwriters' Laboratories); Plastics for Fixtures and Signs (F. W. Tetzlaff, Rohm & Haas Co.); and Radiant Glass Heating (B. A. Needham, Continental Radiant Glass Heat Corp.) among other technical agenda subjects.

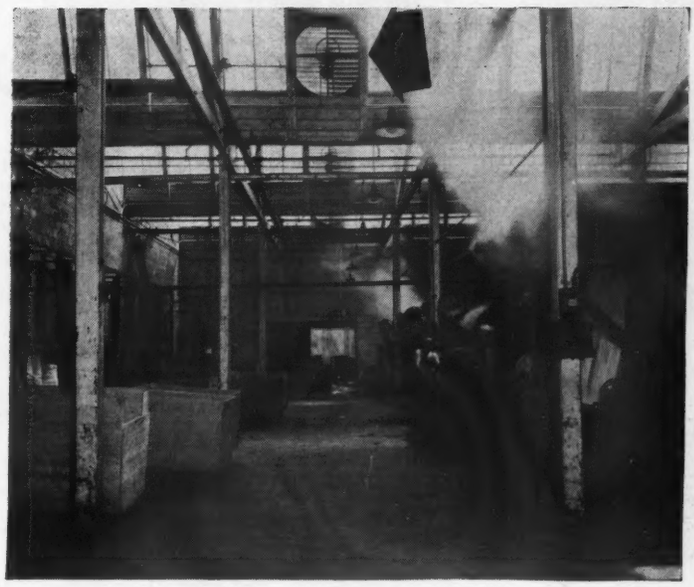
As a result of action taken by the Executive Committee this past February, honorary membership in the Western Section was granted posthumously to Victor H. Tousley at the conference.

Three new IAEI Chapters—Ontario, New Mexico and South Dakota—received charters at the Denver meeting.

Officers elected to guide the activities of the various Sections during the coming year were:

Western Section—President—W. C. Cale, Toronto, Ontario; first vice-president—W. J. Alcock, Chicago; second-vice president—Otto E. Rad-

AIR EQUIPMENT TO HELP YOUR BUSINESS



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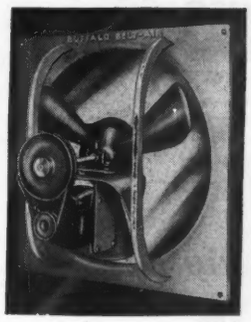

For larger capacity free air delivery in industrial and commercial establishments you'll get best results from installation of economical, efficient "Buffalo" Belt-Air Fans. Easy to install, with flange-edged square frame. Sturdy construction insures trouble-free operation under heavy-duty service. Five sizes, 24"-48"; 4,400 to 19,000 cfm.

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CUTTING COSTS IN EVERY BRANCH OF INDUSTRY

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A. C. OR D. C. OPEN OR CAN TYPE WITH TUBE-BASE PLUG-IN FEATURES

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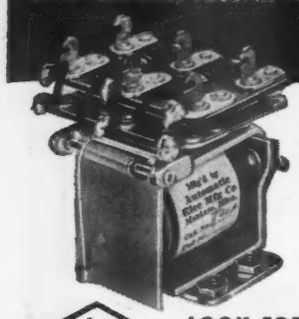
Compact, *carefully engineered* Automatic Time Switches have new type, easily set trip levers. Trip levers and dial are visible thru window in attractively finished, tamper-proof case.

Stock Models: Single Circuit, Single Pole, 10 Amperes Capacity to Two Circuit, Four Pole, 45 Amperes Per Pole Capacity. Special models engineered to your requirements.



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Automatic Electric Relays . . . Midget, Interlocking, Circuit Control, Latching, Adjustable . . . are built to exacting high standards to assure unexcelled dependability. Custom built relays designed to your specifications.

Accurately rated Automatic Electric Relays deliver "Diamond Quality" performance.

Write for complete specifications.

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WHO SPECIALIZE IN *NEW HOME* WIRING . . .

To handle a product that automatically can be figured in on every NEW HOME WIRING job . . .

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Made of cast aluminum . . . so durable and simple in construction it can't get out of order. It operates on the doorbell transformer at an electricity cost of only 2c per week. Approximately 5,000 have already been sold in Milwaukee by only a few outlets. Recommended and boosted by electric leagues and electric companies.

It's a natural for electrical contractors who specialize in new home wiring. Experience shows it can be figured in on every job, and it is proving to be a fine goodwill builder besides. One contractor is figuring it in on 400 new home jobs this year.

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CURTIS DEVELOPMENT & MFG. CO.

Manufacturers of well-known line of Curtis Terminal Blocks

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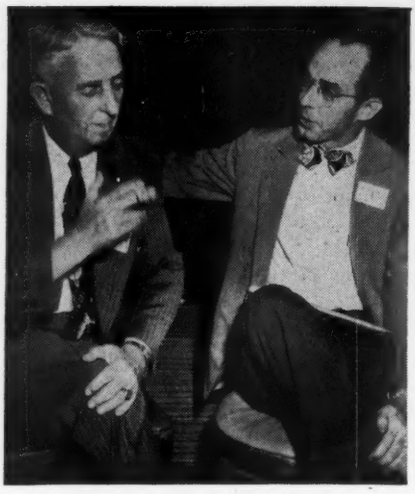


C. J. Lawell, dist. electrical inspector, P. S. Co. of Northern Indiana, Hammond, and Kent P. Stiner, electrical inspector, Detroit have post-session confab at Denver IAEIA conference.

tke, Cleveland, Ohio; secretary-treasurer—F. H. Moore, Indianapolis, Indiana.

Northwestern Section—President—R. R. Grant, Havre, Montana; first vice-president—D. J. Wolters, Salt City, Utah; second-vice president—A. E. Dickey, Boise, Idaho; secretary-treasurer—W. L. Gaffney, Tacoma, Washington.

Southwestern Section—President—J. K. Ross, San Bernardino, Calif.; first vice-president—R. B. Maxwell, San Jose, Calif.; second vice-president—E. V. Muller, Los Angeles; secretary—treasurer—H. G. Ufer, Los Angeles.

Eastern Section—President—B. A. McDonald, Rochester, N. Y.; first vice-president—B. B. Whelan, Boston, Mass.; second vice-president—B. F. Greene, New York, N. Y.; secretary—F. N. M. Squires, New York, N. Y.: treasurer—A. W. Hopkins, Springfield, Mass.

Southern Section—President—A. E. Hancock, Austin, Texas; first vice-president—J. N. McCammon, Jackson, Miss.; second vice-president—W. W. Fowler, Columbia, S. C.; secretary—A. M. Miller, Richmond, Virginia; assistant secretary—C. M. Dones, Atlanta, Georgia.

IES Annual Technical Conference

Attendance at the 40th annual Technical Conference of the Illuminating Engineering Society, held in Boston, Mass., on September 20-24, exceeded 1000, highest attendance on record. Members and guests came from every state, Canada, Cuba, and many foreign

countries, for the week long Conference.

The Conference program consisted of an opening general session, six technical papers sessions, a Technical Committee Forum session, progress report, Residence Lighting Forum session, and a pre-conference Lighting Service Forum dramatic presentation of "IES Was There", demonstrating overall progress being made in lighting practice. The technical sessions were supplemented by the President's Night reception, dinner and dance, a shore dinner, and various other social and sight seeing events.

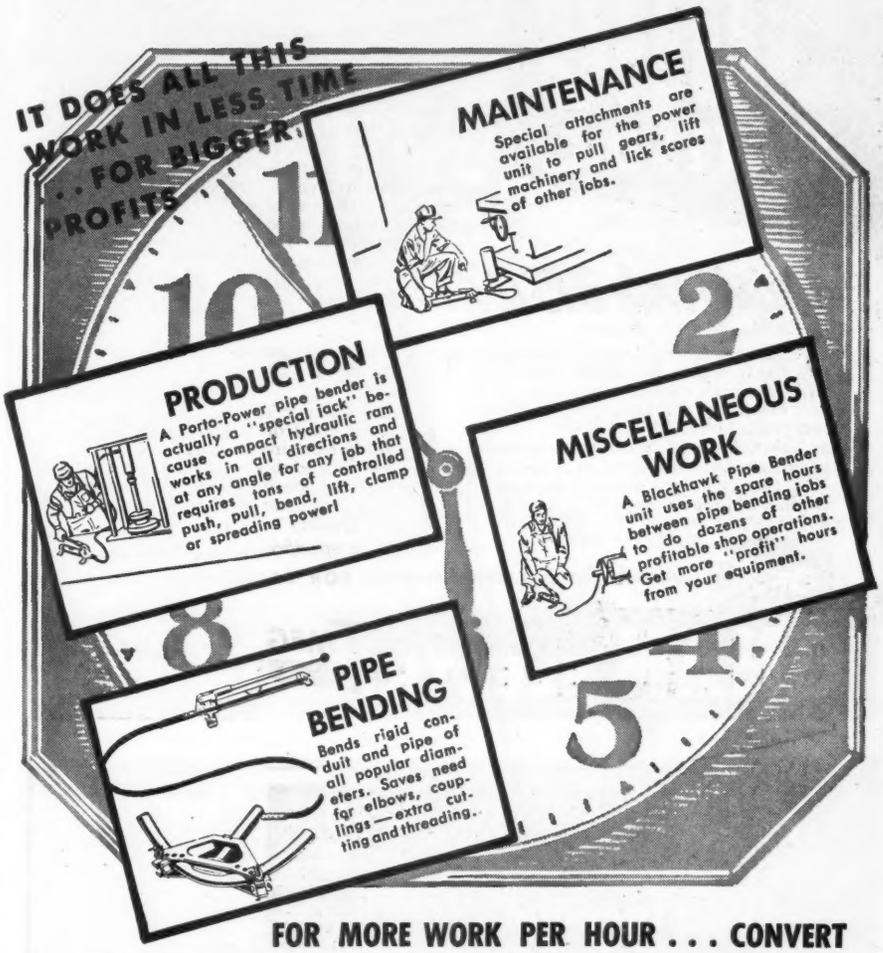
General Session — The Conference was formally opened at the General Session, with an address of welcome by George C. King, Boston Edison Co. Walter Sturrock, General Electric Co., gave the report of the General Secretary.

R. W. Staud of the Benjamin Electric Manufacturing Co., the Society's President, reviewed the Society's accomplishments during the past year in his Presidential Address, and outlined the financial policy and procedures of the Society. Looking to the future he said, "We can see clearly that the progress which we are making will result in new understanding of the importance of the right kind of illumination for children and for adults of all ages. The tempo of progress will be accelerated. In the next ten years illumination levels on the order of 100 footcandles will become generally accepted.

Incoming president Lee E. Tayler of the Detroit Edison Company outlined his program for the coming year in his talk "Charting Our Course for 1948-1949". Stressing the importance of the Society's basic purposes he said, "Let us remember that we do hold a unique position among Engineering Societies because of our ramified interests and responsibilities and because everything we do is in the interest of the public." Describing the work of the Society Mr. Taylor reported, "There are today 88 Standing, General and Technical Committees and Sub-Committees plus 19 appointments of representatives to other organizations. Working on these committees are 869 members of the Society giving freely of their time in developing the Art and Science of illumination".

Preston S. Millar of Electrical Testing Laboratories, who was chairman of the U. S. National Committee of 15 delegates to the eleventh session of the International Commission on Illumination held in Paris during the past summer, reported on the activities of the U. S. delegates at these sessions. "Resolutions and recommendations developed in the technical sessions for

THE ONLY PIPE BENDER UNIT THAT "WORKS" WHEN THERE'S NO PIPE TO BEND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Special attachments are available for the power unit to pull gears, lift machinery and lick scores of other jobs.
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A Porto-Power pipe bender is actually a "special jack" because compact hydraulic ram works in all directions and at any angle for any job that requires tons of controlled push, pull, bend, lift, clamp or spreading power!
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A Blackhawk Pipe Bender unit uses the spare hours between pipe bending jobs to do dozens of other profitable shop operations. Get more "profit" hours from your equipment.
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Bends rigid conduit and pipe of all popular diameters. Saves need for elbows, couplings — extra cutting and threading.

FOR MORE WORK PER HOUR . . . CONVERT YOUR HAND-OPERATED PIPE BENDER TO POWER OPERATION

NEW P-182 Electrically-Driven Hydraulic Pump Brings You Speed, Power and Greater Economy

The amazing P-182 pump enables one man to easily bend any size pipe. Single control knob leaves hands free for measuring, etc. P-182 slashes pipe bending time — eliminates fatigue. It's a complete "profit package" containing pump, reservoir, valves and controls. Get full details on the new P-182 from your Blackhawk Industrial Supply Distributor.

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Model 5CK-115M, 5,000 watts, 115 volts D.C.

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NEW ONAN "CK" ELECTRIC PLANTS are available in 5000 watts D.C., 115 and 230 volts; 2000 and 3000 watts A.C. in all standard voltages. COMPLETE ELECTRIC PLANT LINE INCLUDES: A.C.—350 to 35,000 watts in all standard voltages and frequencies. D.C.—600 to 15,000 watts, 115 and 230 volts. Battery Chargers—500 to 6,000 watts, 6, 12, 24, 32 and 115 volts. ONAN AIR-COOLED ENGINES—CK: 2-cylinder opposed, 10 HP. BH: 2-cylinder opposed, 5½ HP. IB: 1-cylinder, 3¼ HP.

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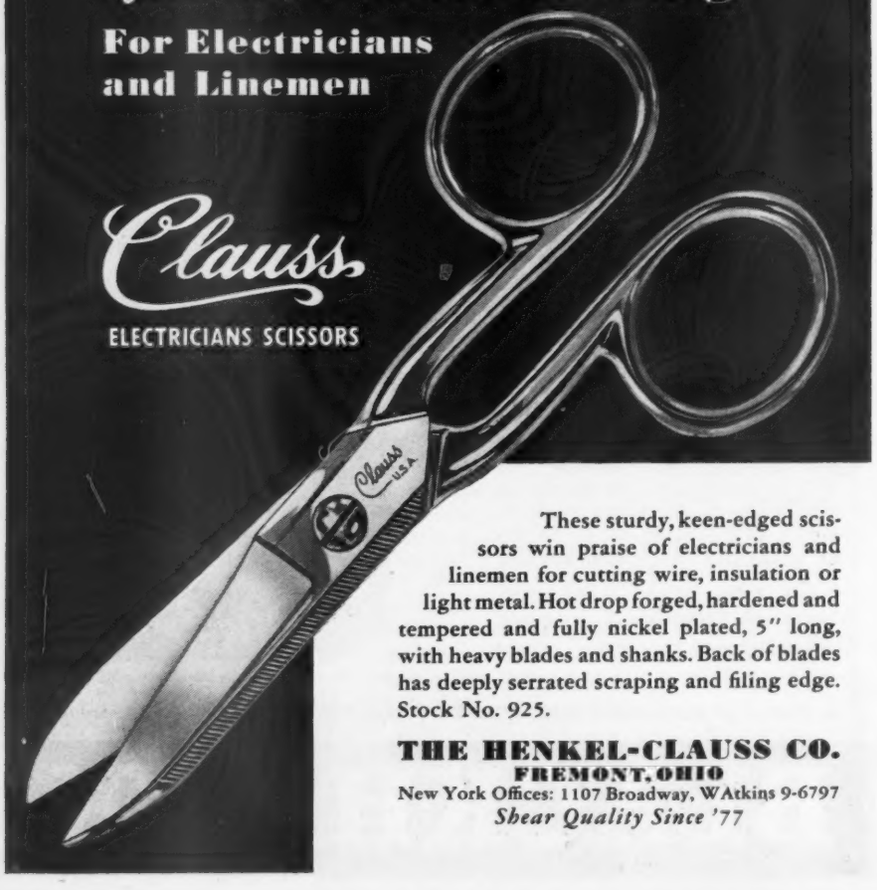

These sturdy, keen-edged scissors win praise of electricians and linemen for cutting wire, insulation or light metal. Hot drop forged, hardened and tempered and fully nickel plated, 5" long, with heavy blades and shanks. Back of blades has deeply serrated scraping and filing edge. Stock No. 925.

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the most part were suggestive as to programs of further study and experimentation in order to develop the respective fields of knowledge," he reported. Six of the 22 technical papers that supplemented the Technical Committee Reports were presented by Americans, Mr. Millar stated, and included reports on Colorimetry, Lighting of Public Ways, Lighting Practice and Cinema Lighting.

Mr. Millar also reported on the presentation of the 1948 IES Medal, awarded to Sir Clifford Patterson of Hertfordshire, England, to Mrs. Patterson at Sir Clifford's home on July 22. Normally presented at the Society's Annual Conference, Mr. Millar was officially delegated by the IES Council to make the 1948 Medal presentation in England, when it was learned that Sir Clifford would be unable to be present, due to illness. Sir Clifford died four days later, on July 26.

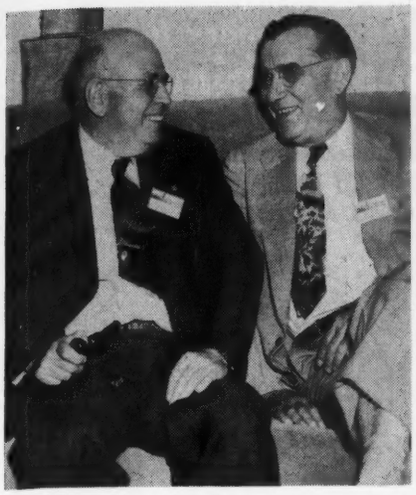
Technical Sessions—A total of 28 technical papers, covering various subjects ranging from basic theory to lighting application techniques were given during the four-day technical sessions program. These included four papers related to lamp design and manufacture, five papers in the field of street lighting, three papers describing developments in louverall lighting techniques, four papers on theory basic to the science of seeing, one paper on airport lighting systems, five papers on residential lighting and other papers on various popular lighting subjects.

Lamp Design and Manufacture—Clifton G. Found and W. J. Winninghoff, General Electric Co., gave a paper on "Comparison of Argon and Krypton as a Filling Gas in Fluorescent Lamps", in which it was pointed out that krypton would give a three percent advantage in efficiency over argon in the present 40-watt lamps, but would require a new ballast in order to operate at the same wattage or with the same light output as the present argon-filled lamps.

The addition of a very small amount of an antimony compound to the phosphor in fluorescent lamps has a marked effect on light output maintenance, it was reported by Erwin F. Lowry and Eric L. Mager, Sylvania Electric Products, Inc., in a paper on "Some Factors Affecting the Life and Lumen Maintenance of Fluorescent Lamps".

Progress made in phosphors for fluorescent lamps over the past ten years, and a very precise control of small color variations in "white" fluorescent lamps by design of phosphor combinations, was discussed by Keith H. Butler, Sylvania Electric Products, Inc., in a paper on "The Design of Fluorescent Lamp Phosphors".

Use of larger arc tubes and bigger



Chances are that George Garney (left) executive-secretary, Minnesota State Board of Electricity, St. Paul, and I. A. Paige, vice-president, Allied Electric Mfg. Corp., Chicago, are swapping electrical stories at recent Denver, IAEI conference.

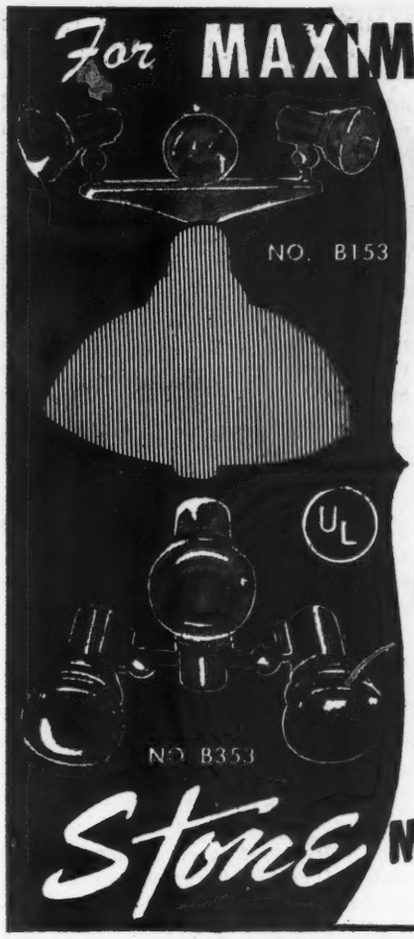
outer jackets in new designs of the 250- and 400-watt quartz lamps, provides higher efficiency, better maintenance, and longer life, and permits satisfactory operation in any position, it was reported by Edward B. Noel, General Electric Company, in a paper on "Mercury Lamps Redesigned for Improved Light Output and Performance".

Louverall Lighting—R. R. Wylie, Sylvania Electric Products, Inc., discussed the "Relation of Louver Shielding and Finish to Luminaire Output".

Benjamin S. Benson, Jr., Benjamin Electric Mfg. Co., stated that adequate shielding, high system efficiency, pleasing appearance and minimum direct and reflected glare constitutes the four basic considerations in "Louverall Lighting Techniques", the title of his paper on this subject.

Wentworth M. Patter and R. L. Oetting, General Electric Company, presented tabular, graphical and pictorial data useful in appraising the effects of a number of variables inherent in the design of louver and louverall systems. The data for their paper, "Design and Illumination Characteristics of Louver and Louverall Systems", are based upon approximately 700 tests involving about 100,000 individual readings and uncounted calculations.

Residential Lighting—A technical session covering residential lighting involved five separate papers and various phases of lighting in the home. Eugene W. Commery, General Electric Company, presented an analysis, discussion and measurements to clarify the functional objectives that modern floor and table lamps may contribute to the home in a paper on "Designing Portable Lamps for Lighting Effectiveness".



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NO. B 353—3 light assembly uses 300 or 500 watt sealed beam weather-proof floodlamps.

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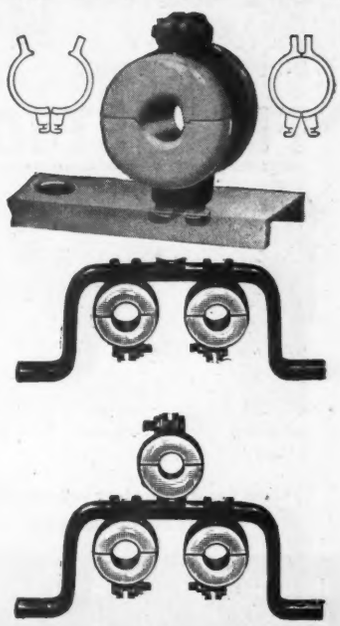

Designed to carry conductors equidistant from center to center . . . Efficiency patented racks feature porcelain bushings and require but one bolt to support bushing and clamp it to the steel frame. Clamps are separate, allowing independent installation of each cable line. Furnished for your requirements for cable from 5/16" to 2⅜" diameter.

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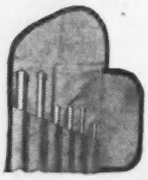

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Single Conductor Pothead

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ENDULATORS (POTHEADS) ALL SIZES • ALL SHAPES • ALL VOLTAGES • ALL TYPES • BUS SUPPORTS • SPLICING KITS AND MATERIALS • INSULATING COMPOUNDS

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14260 Birwood Avenue • Detroit, Mich.

Mary Webber, General Electric Company, analyzed the lighting results obtained from 20 representative luminaires that are popularly advocated and used for home study, in a paper on "Studies of Lighting and Seeing for the Student at Home".

Jan Reynolds, Sylvania Electric Products, Inc., and A. W. Kakilty, Duquesne Light Company, reported that generally kitchens are not well lighted, and that proper attention has not been paid to an analysis of what will actually take place when widely advertised lamps and fixtures are used in the locations for which they are sold, in their joint paper on "An Appraisal of Kitchen Lighting Elements".

Thomas S. Kelly, Thomas Smith Kelly Lighting, discussed "Methods of Illuminating Art Objects and Pictures", stressing the artistic result rather than pure engineering efficiency.

Priscilla Presbrey and Myrtle Fahsbender, Westinghouse Electric Corp., presented the results of a study of lighting results produced by a group of selected luminaires typical of those for reading in bed, in a joint paper on "Performance Analysis of Available Lighting for Reading in Bed".

Street Lighting — Better "white ways" increase business, reduce fire losses, assist the police, assure safe traffic flow, and attract industries to a town, A. F. Dickerson, General Electric Company pointed out in a paper on "Modern White Ways".

L. J. Schrenk, City of Detroit, discussed the City of Detroit's maintenance organization, street lamp characteristics, luminaires, burning hours, replacement schedules, maintenance equipment, benefits and public relations in a paper "On Keeping the Street Lights Bright".

Basic Theory—Dr. M. Luckiesh, General Electric Company, in a paper on "Important Concepts Underlying Lighting for Critical Seeing", discussed visibility and ease of seeing, suprathreshold visibility levels, brightness engineering, and similar factors.

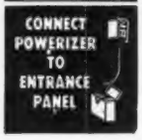
T. A. Ryan, C. L. Cottrell and M. E. Bitterman of Cornell University reported on investigations of "Muscular Tension as an Index of Visual Efficiency". These experiments are in the early stages of development, and no conclusions have been drawn.

R. A. Coradeschi and L. E. Innis, Ainsworth Lighting, Inc., presented a method which enables the construction of interflection tables for any luminaire, in a paper on "The Construction of Interflection Tables for Specific Luminaires".

Henry L. Logan, The Holophane Company, outlined the steps to be employed by the engineer in designing all the elements of a lighting system and the interior environment, to provide

Revolutionary Test Unit
Spots Wiring Faults Instantly

ELECTRICAL
WIRING ANALYZER



- **Checks new or old wiring systems under simulated load conditions.**
- **Instantly identifies each outlet circuit number and polarity.**
- **Instantly detects fire hazard hidden faults due to bad splices, corroded or loose connections, etc.**

Powerizer Source **attaches to entrance panel, supplies simulated load and identifying current.** ***Special D'Arsonval Rectifier Meter*** **plugs in outlet, shows (1) Circuit number, (2) Insulation resistance, (3) Ground resistance, (4) A-C Volts. Merely turn Range Selector knob for the scale desired. Approved and used by leading fire and electrical inspectors in major cities. Only $149.50. Order direct, or write for literature.**

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PIPE STRAPS
For Heavier Loads!

Designed for use on loads too heavy for one-hole Jiffy clips. Made of all new zinc plated tempered steel to give strength and rigidity enough to support heavier pipes, cables, conduits, etc. Available in sizes to fit pipes and conduits from ½-in. to 1-in. Can also be had in Everdur, copper, brass or aluminum.

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Specify **MINERALLAC** **HANGERS, CLIPS, STRAPS, BUSHINGS**

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what may be broadly described as a biologically correct lighting environment, in his paper on "The Practical Mecahnics of Designing Optimum Lighting Patterns".

Other Technical Papers—The new type runway lights designed for and installed at Idlewild Airport, New York, and other lighting and landing aids were described and discussed by A. P. Kopf and Willis A. Pennow, Westinghouse Electric Corp., in a joint paper on "The Lighting System for New York's New International Airport".

J. S. Hamel, consulting engineer, stressed the importance of architects and engineers in lighting application work, and the need for them to be prepared and take more initiative in lighting, in his non-technical paper, "Is Lighting Application a Lighting Problem?".

W. G. Darley, consulting engineer, advocated a new approach to lighting based upon a comfortable visual environment, in his paper on "Applied Brightness Engineering from the Consulting Engineer's Viewpoint".

Ray P. Teele, National Bureau of Standards, presented a paper covering "Yardsticks in Lighting—The IES Testing Guides", which summarized the Guides prepared by the Committee on Testing Procedure for Illumination Characteristics, of which Mr. Teele was chairman.

G. B. Buck, II, General Electric Company, discussed errors inherent in present day type light meters using selenium barrier-layer type light sensitive cells and described a new technique of light cell construction by which these errors can be largely or wholly eliminated. The title of this paper was "The Correction of Light-Sensitive Cells for Angle of Incidence and Spectral Quality of Light."

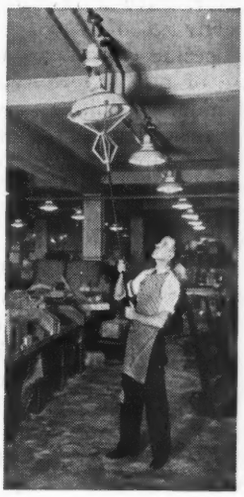
C. J. Allen and R. E. Holmes, General Electric Co., reported on "Studies in Gymnasium Lighting", and recommended a three-step lighting system with switching provisions to provide the flexibility needed for various gymnasium activities.

"Engineering Aspects of Cove Lighting Design" was the subject of a paper presented by Lorin C. Brown and J. R. Jones, Westinghouse Electric Corp.

Progress Report—Samuel G. Hibben, Westinghouse Electric Corp., gave a Lighting Progress Report for 1947-48. Mr. Hibben dramatized this report by showing new units and new developments, which he had set up on the stage. These new units included a super sports floodlight of 1750 watts with a thin but shatterproof glass lens, infrared unit designed to aid in replacement of linoleum, fluorescent treated fabrics which glow in daylight as well

More Efficient Lighting *with* **ABolite**

DUO-MOVE SYSTEM OF MAINTENANCE



QUICK REPLACEMENT — EASY TO CLEAN — SAVES TIME & LABOR

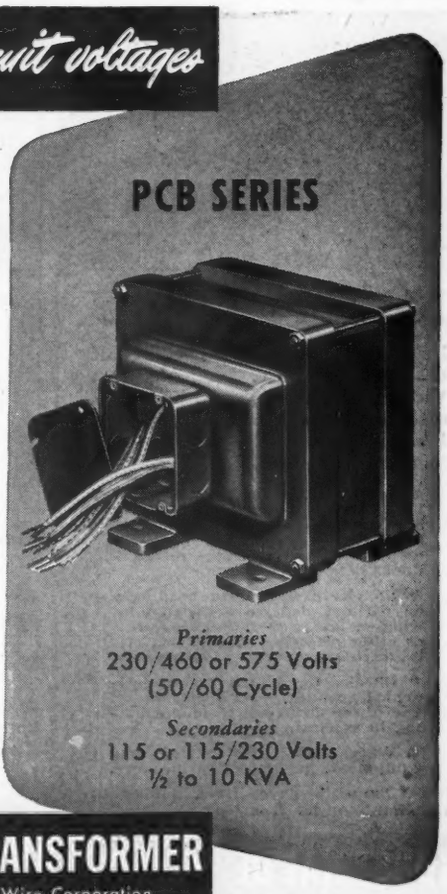
ABolite DUO-MOVE type reflectors consist of a hood with separable socket which remains permanently attached to the conduit. The lower member of socket is attached to metal collar at top of reflector neck. This permits reflector and lamp to be taken down as a unit. With the Duo-Move Changer, maintenance is so easy and quickly accomplished you can always have clean reflectors and bright, efficient lighting. DUO-MOVE and separable socket type reflectors are available in RLM standard dome, shallow dome, deep bowl and mercury vapor types. ABolite Reflectors are sold exclusively through electrical wholesalers.

Light right with ABolite REFLECTORS PORCELAIN ON STEEL

THE JONES METAL PRODUCTS CO., West Lafayette, Ohio

Step down main circuit voltages

—with CHICAGO *Power Circuit* **TRANSFORMERS**



- **Convenience In Wiring —** Attached outlet boxes provide large, easily accessible wiring compartments for lead connections, take conduit or flexible cable from all 4 sides.
- **Flexibility In Mounting —** Units can be mounted as shown at right, up-side-down, or in any other position; rugged frames and mounting feet provide strong, rigid support.
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Write for prices and further details.

Primaries
230/460 or 575 Volts
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115 or 115/230 Volts
½ to 10 KVA

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NO-KINK FISH TAPE

Pushes and pulls around four 90° bends in aluminum conduit and six in steel with ease. Rust proof aircraft control type cable, coil spring covered, will not kink, break or gouge. Slips past boxes and conduit ends no curling—requires fewer boxes and fittings. Lengths 25—50—100 feet.

Jiffy

Clamp-In
BOX SUPPORTS

Quickly and easily installed in any wall. Sheetrock — beaverboard — lath and plaster — metal lath, etc., without screws or nails.

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as under ultraviolet, new high intensity airport runway light, new fluorescent lamps, and many other important developments.

Technical Committee Forum—One session was devoted to the work of the technical committees of the Society. Lee E. Tayler, senior vice-president, gave a general outline of the scope of technical programs, and C. L. Crouch, technical director, gave a review of the technical activities of the Society outside of its specific committees and including those of the IES Research Fund. In addition, committee chairmen gave brief reports on work being done by Task committees on library, sports, and store lighting, public buildings, study projects in industry, lighting in laundries, lighting in the woolen industry, and illumination performance recommendations.

IBEW Meets In Atlantic City

Business and job opportunities in the electrical contracting industry will remain very good with continued cooperation between contractors and the International Brotherhood of Electrical Workers.

That is the message Robert W. McChesney, president of the National Electrical Contractors Association, brought to the IBEW's 23d convention at Atlantic City.

McChesney, an IBEW member since 1910, was warmly received by IBEW President Dan W. Tracy and the 2,500 delegates, who applauded his denial that "bust must follow boom."

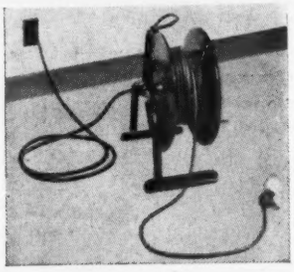
Business is heading into a "major adjustment period" after the next few years of continued high prices, high wages and high taxes, McChesney said, but with good sense this can be done "without falling on our faces." But it will take "real statesmanship and exercise of moderation by all of us, the employers and employees," he added.

McChesney said the industry's prosperity for the next ten years can be measured by the real need for electrical construction and maintenance in practically every field of human endeavor. By 1957, he said, increase in business is expected in four categories as follows:

Residential—consumers up from 30 million to 34 million; average annual consumption for each up from 1,389 to 2,400 kilowatt hours; total consumption up from 41 billion to 62 billion kilowatt hours.

Farm—Farm customers up from 3,817,000 to 5,400,000; average kilowatt hours up from 2,339 to 4,000; total kilowatt hours up from 9 billion

HyKon
EXTENSION CORD REEL



HyKon

offers new advantages

Equipped with a totally inclosed 30 AMP. Collector. Weighs only 15 lbs. Cord capacity 250 ft. 16-2, 200 ft. 14-2, or 150 ft. 12-2.

Portable—easy to handle—long cord life—hand rewind—no kinks. Now being used by —Building contractors—steel mills—railroads —manufacturers—warehouses—portable tool users.

Bulletin available—Write.

HyKon Mfg. Co.
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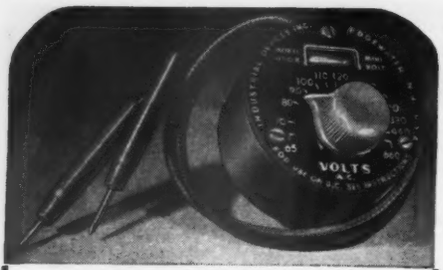

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Instantly read voltages right off dial. 65 to 660 v. AC. Also DC. Virtually burnout-proof. Guaranteed for 10,000 hours' operation. Plastic case. 12" flexible test leads. ***And only $2.50 list!***

- **Not only distinguishes between 110, 220 etc. volts, but measures line voltage close enough to show up to 3 or 4 volt drop between meter and load terminals on 110 v. line.**
- **No electrical worker need now be without definite knowledge of whether faulty operation of motors, or other electrical equipment, etc. is due to improper terminal voltage.**
- **Checks for blown fuses, accidental grounds, circuit continuity. Useful for electrical trouble-shooting in general.**
- **Warns of "live" wires and equipment, as protective measure.**

It's a "must." Saves time, money, life and limb! Order from supplier, or from

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Do Night Maintenance in Daylight with

Big Beam
PORTABLE ELECTRIC HAND LAMPS

Dry-Cell—Storage-Battery Models

A Big Beam insures better nightwork and maximum safety for the men.
Model No. 311—Spillproof Rechargeable Electric Hand Lamp. Model No. 312 equipped with built-in charger.
Write for full information on accessories and other models, or see your supplier..

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to 21 billion. Practically all REA-financed systems will have to be rebuilt to provide for heavier loads.

Small Industrial and Commercial—Total kilowatt hours up from 38 billion to 58 billion; new lighting standards requiring seven times the present light; more air conditioning and more motors.

Large Industrial and Commercial—Total kilowatt hours up from 113½ billion to 194 billion. Many industries—particularly chemical and paper, petroleum, coal, iron and steel and non-ferrous metals—are increasing kilowatt hour consumption per unit of production.

McChesney reviewed the past cooperation between NECA and the IBEW, citing the Council on Industrial Relations for settling labor-management disputes without strikes; the Employees Benefit Agreement under which electrical contractors contribute 1% of their IBEW payroll toward pensions, and the apprenticeship and training program. He then urged cooperation in still another way—promotion of the use of electricity by all persons who get a living from the electrical industry. He called it the Electrical Interdependence Program.

Cooperation was also asked of IBEW members in going after much of the modernization and repair business which McChesney said the industry does not get.

He criticized the "many incompetent contractors" as a hindrance in the development of new business, and assured the delegates that it is to the advantage of the electrical worker to have more competent and successful contractors.

IBEW membership has risen from 350,000 to 450,000 since the last convention at San Francisco in 1946. The union's assets were reported at $9,600,000.

NLRB Appealing Court Decision in Denver

Robert N. Denham, general counsel of the National Labor Relations Board, has gone to the U. S. Circuit Court of Appeals in Denver to prove his right to obtain injunctions against secondary boycotts in the building and construction industry.

Denham took his step after Federal Judge J. Foster Symes of Denver, for the second time, refused to grant his plea for an injunction against the Denver Building Trades Council and locals of the IBEW and other AFL unions.

Judge Symes held in both cases that the construction activity affected was local in character and did not affect interstate commerce. In the second

BE READY FOR EMERGENCY REPAIRS!
Quick deliveries on large or small orders.

Superior brushes in carbon graphite and electrographitic grades are carried in many stock sizes, as below, from 1½" x 1" x ¼" to 2½" x 1¾" x ¾", also in intermediate sizes in increments of ½" long, ¼" wide, and ⅛" thick up to 2½" in length. (CORRECTED AD.)

All brushes are equipped with standard shunts. Get our complete list of standard Superior grades which can be ordered by code number.

Size—Inches L.	W.	T.	Stock Numbers Grade 440	Grade 460
1½	1	¼	A00	B00
1½	1	⅜	A01	B01
1½	1	½	A02	B02
1½	1	⅝	A03	B03
1½	1¼	¼	A04	B04
1½	1¼	⅜	A05	B05
1½	1¼	½	A06	B06
1½	1¼	⅝	A07	B07
1½	1½	¼	A08	B08
1½	1½	⅜	A09	B09
1½	1½	½	A10	B10
1½	1½	⅝	A11	B11
2	1	⅜	A12	B12
2	1	½	A13	B13
2	1	⅝	A14	B14
2	1	¾	A15	B15
2	1¼	⅜	A16	B16
2	1¼	½	A17	B17
2	1¼	⅝	A18	B18
2	1¼	¾	A19	B19
2	1½	⅜	A20	B20
2	1½	½	A21	B21
2	1½	⅝	A22	B22
2	1½	¾	A23	B23

(NOTE: Grade 440 is Carbon Graphite) (NOTE: Grade 460 is Electrographitic.)

Size—Inches L.	W.	T.	Stock Numbers Grade 440	Grade 460
2	1¾	⅜	A36	B36
2	1¾	½	A37	B37
2	1¾	⅝	A38	B38
2	1¾	¾	A39	B39
2½	1	⅜	A24	B24
2½	1	½	A25	B25
2½	1	⅝	A26	B26
2½	1	¾	A27	B27
2½	1¼	⅜	A28	B28
2½	1¼	½	A29	B29
2½	1¼	⅝	A30	B30
2½	1¼	¾	A31	B31
2½	1½	⅜	A32	B32
2½	1½	½	A33	B33
2½	1½	⅝	A34	B34
2½	1½	¾	A35	B35
2½	1¾	⅜	A40	B40
2½	1¾	½	A41	B41
2½	1¾	⅝	A42	B42
2½	1¾	¾	A43	B43

(NOTE: Grade 440 is Carbon Graphite) (NOTE: Grade 460 is Electrographitic)

NOTE — ¼" and ⅜" thick brushes supplied with 3/16" open terminals — other ¼" open terminals.

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"Since 1919" SUPERIOR CARBON BRUSHES

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The Threadless Fitting Line of Unequalled Variety

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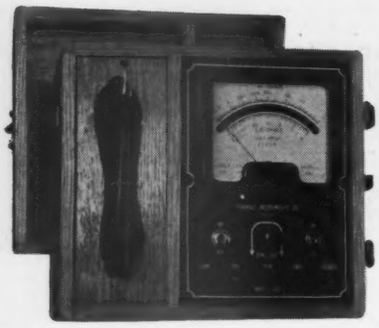
The New Model 460 INSULATION TESTER



Quickly & accurately measures insulation leakage from zero to 200 megohms at a test potential of 500 volts. NO HAND CRANKING, built in power supply saves time and effort.

4 RANGES

0/200/20,000 ohms
0/2/200 megohms.

The low range (10 ohms center scale) reads as low as 1/10 of an ohm, making possible correct testing of coils, armature windings, etc. The Model 460 housed in a hand-rubbed Oak cabinet, comes complete with self contained batteries, test leads and all instructions for only $44.50 net.

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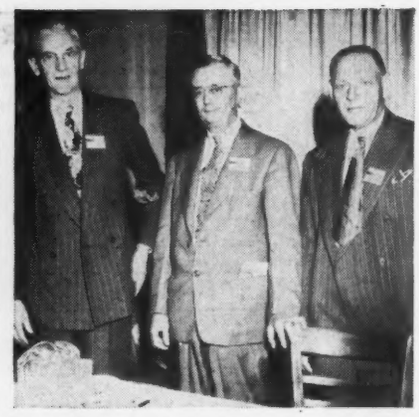

Executive trio of the Western Section IAEI: Past-president R. C. Loughead of Detroit; new president W. C. Cale of Toronto, Canada; and second vice-president Otto E. Radtke of Cleveland, Ohio.

case, a NLRB trial examiner also dismissed unfair labor practice charges filed by Denham on the basis of Judge Symes' view that the Taft-Hartley law lacked jurisdiction because interstate commerce was not affected.

Here are the two cases:

1. Gould & Preisner, Denver electrical contractor, was placed on an "unfair" list and a housing project on which it had a subcontract was picketed by AFL unions. Although Judge Symes declined to issue an injunction, a trial examiner of NLRB has recommended that the unions be held guilty of a secondary boycott unfair labor practice under the Taft-Hartley law. Final decision by NLRB is pending.

2. Grauman Co., Denver manufacturer of soda fountain equipment, was placed on an "unfair" list by the building trades council. The council and locals of AFL electricians and plumbers are accused of getting union employees of Acme Electric Co. and McCarty-Johnson Plumbing & Heating Co. to refuse to make under-floor connections for installation of Grauman's fixtures in a Denver restaurant. Denham brought charges against the AFL at Grauman's request, then sought the injunction, a mandatory step in secondary boycott situations.

The five-member NLRB has yet to say how far it will go in extending its jurisdiction over the building and construction industry. It has taken jurisdiction over most building supplies distributors.

The first decision on home building is expected to come from NLRB on the secondary boycott charges filed by Watson's Specialty Store in Chattanooga Tenn., against the carpenters. The union carpenters allegedly quit work on a house because non-union men were laying floor and wall covering for Watson's.

Another case heading for decision involves secondary boycott charges

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SIMPLEX REEL JACKS

- Stable, T-Shaped Base
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- 10 Models
- 1—15 Tons Capacity

SIMPLEX POLE JACKS

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- 5' Steel Lever Bar
- 3 Models
- 5—15 Tons Capacity

Get man-hour savings that really cut construction and maintenance costs with these rugged Simplex Jacks. Get fast, safe jacking, with easy operation that speeds work!

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CONCRETE DRILL BITS
PROVE FOR YOURSELF THAT ROTARY CONCRETE DRILL BITS
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Costs *"per hole"* tumble, when you use ROTARY *Concrete Drill Bits* in concrete, brick or marble. Pressure and heat resistant, last longer, drill easier, cleaner and faster.

For use in electric drills. Exclusive, quiet *pulverizing* action cuts clean, sharp, precision holes... FAST! No noisy hammering or chiseling. *No other drill bit like it.*

Used by all industries, Contractors, Telephone and Electric Utilities, who know... IT'S THE COST PER HOLE THAT COUNTS. Order direct! Write for information or free trial demonstrator.

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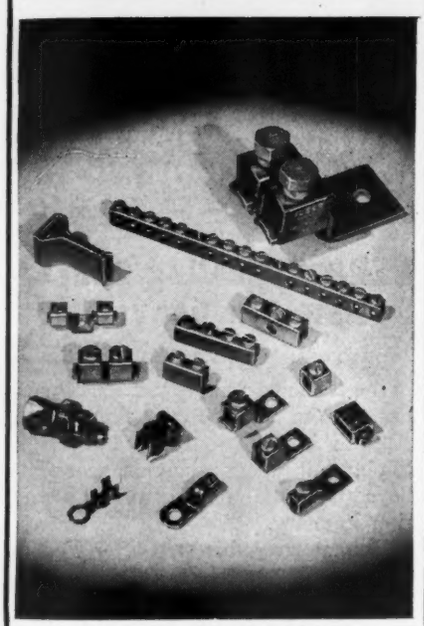

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brought against the carpenters by Klassen & Hodgson, Inc., Kansas City building contractor erecting a prefabricated housing development in Overland Park, Kan.

IAEI Adds Three New Chapters

Three new chapters of the International Association of Electrical Inspectors were granted charters at the recent Western Section convention in Denver, Colorado. They are designated as the Ontario, New Mexico and South Dakota chapters. Officers of the respective groups are as follows:

New Mexico—Chairman—E. S. Butt; vice-chairman—Elmer Kaemper; secretary-treasurer—Elmer Zemke.

Ontario—Chairman—E. W. McLeod; honorary chairman—A. G. Hall; first vice-chairman—F. R. Whatmough; second vice-chairman—J. J. Cleaver; secretary-treasurer—Norman A. Cockburn.

South Dakota — Chairman — John Brende; vice-chairman — Roy C. Fisher; secretary-treasurer—A. U. Haugen.

Dates Ahead

National Electronics Conference — Edgewater Beach Hotel, Chicago, Ill., November 4-6.

National Electrical Manufacturers Association—Traymore Hotel, Atlantic City, N. J., November 7-12.

Electrical & Gas Association of New York, Inc.—Luncheon meeting, Grand Ballroom, Hotel Astor, New York, N. Y., November 17.

National Farm Electrification Conference—Congress Hotel, Chicago, Ill., November 17-19.

National Electrical Contractors Association — 47th Annual Meeting, Roney Plaza Hotel, Miami, Fla., November 30-December 3.

Electrical & Gas Association of New York, Inc.—Luncheon meeting, Grand Ballroom, Hotel Astor, New York, N. Y., December 22.

Independent Electrical Contractors Association, Inc.—43rd Annual dinner, Hotel Astor, New York, N. Y., January 15, 1949.

American Institute of Electrical Engineers—Winter general meeting, Pennsylvania Hotel, New York, N. Y., January 31-February 4, 1949.

Electrical League of Milwaukee—Annual industry dinner dance, Hotel Schroeder, February 12.

National Electrical Manufacturers Association—Winter convention, Edgewater Beach Hotel, Chicago, Ill., March 13-18, 1949.

Third International Lighting Exposition and Conference—Hotel Stevens, Chicago, Ill., Week of March 28, 1949.

National Electrical Wholesalers Association—41st Annual Convention, Netherland Plaza Hotel, Cincinnati, Ohio, May 1-6.

Chamber of Commerce—37th annual meeting, Washington, D. C., May 2-5.

National Fire Protection Association—53rd annual meeting, Fairmont Hotel, San Francisco, Calif., May 16-19.

National Industrial Service Association—Annual convention, St. Louis, Mo., June 6-8.

Illuminating Engineering Society — National Technical Conference, French Lick, Ind., September 19-23.

National

FIBERGLAS TREATED TUBINGS ARE MADE TO EXACT SPECIFICATIONS

National Fiberglas tubings are woven and treated in the National plant, on automatic machines which place each thread under precisely controlled tension and impregnate each strand to exactly the desired degree.

Thus the Fiberglas base *invariably* delivers the maximum in resistance to heat and corrosion damage, and precision impregnation insures strict uniformity of performance.

National treatments range from light to heavy saturated with conventional or silicone varnish. All standard sizes are available promptly from stock.

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COLUMBUS 16, OHIO, U. S. A.

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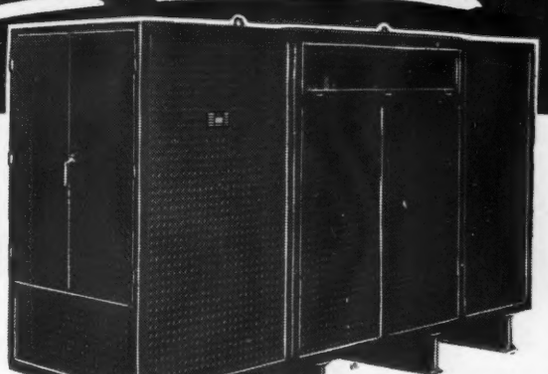

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Marcus Unit Substations are available in sizes from 100 to 1000 KVA in primary voltages up to 15000 V. They are made with various types of entrances and controls for primary, high voltage circuit. The low voltage side can be designed for any type and number of breakers according to customer requirements. Class B and C, heatproof insulation featured throughout.

1000 KVA Transformer with primary and secondary switchgear.

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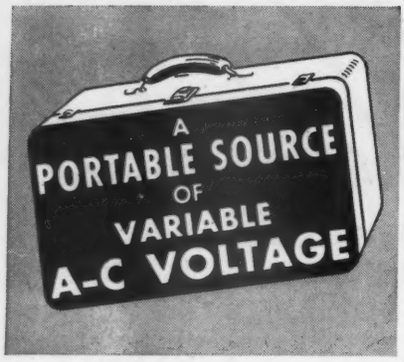
32-34 MONTGOMERY STREET • HILLSIDE 5, NEW JERSEY



VOLTBOX
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- *COMPACT*
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- *HANDY*

Operation of the Superior Electric VOLTBOX is simple. Plug into 50/60 cycle single phase source, snap "ON-OFF" switch to "ON". Snap "LINE-LOAD" switch to "LOAD", rotate knob to produce continuously adjustable output voltage, from 0 to 17 per cent above line voltage. Read line voltage by snapping "LINE-LOAD" switch to "LINE".

TYPE
UC1M

INPUT:	115 volts, 50/60 cycle, single phase
OUTPUT:	0-135 volts, 7.5 amperes, 1000 VA

Type UC2M available for 230 volt operation.

ALL THIS IN ONE PORTABLE PACKAGE

Cast aluminum case • POWERSTAT variable transformer • Easy-to-read voltmeter • Superior 5-Way Binding Posts • Output receptacles • "ON-OFF" switch • "LINE-LOAD" switch • Renewable fuse for overload protection • Six foot cord-plug.

FOR FULL DETAILS WRITE

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COMPANY
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Manufacturers News

General Electric Changes

W. Rex Becker has been appointed sales manager of standard lines for the General Electric Company's conduit products division. He succeeds Ralph C. Dean, who has been named manager of construction materials sales in G-E's north central district, Chicago.

Mr. Becker is succeeded in his former capacity as product promotion manager of the wiring device division by Roger F. Hinckley.

The creation of five new sales districts in the nationwide sales organization of General Electric's Lamp Department has been announced. The new sales districts, their locations, and persons appointed to head each district, are as follows:

New York Sales District, New York City, with Harold A. Olson as manager and Paul H. Ganther as assistant; a new Atlantic Sales District, New York City, with Everett G. Agee as manager; New Jersey Sales District, Newark, with Kenneth C. Larabee as manager; Niagara Sales District, Buffalo, with Harry E. Huff as manager; and Mohawk Sales District, Albany, with Dean M. Warren as manager.

Three appointments in G-E's Transformer and Allied Product Division have been announced. John W. Butler has been named manager of the Commercial Engineering Divisions; C. E. Sutton, Jr., assistant manager, Power Transformer Sales Division; and C. W. Lamplough, manager, Order Service Division.

Vernon L. Cox has been named manager of engineering for the Switchgear Division of G-E. He succeeds C. H. Black, who has been appointed manager of engineering of G-E's Construction Materials Division.

A. F. Vinso, formerly assistant production manager, G-E Apparatus Department, and chairman of the G-E Welding Committee, has been appointed manager of G-E's Welding Divisions.

Guth Company Appointments

The Edwin F. Guth Company of St. Louis has announced the appointment of two resident lighting engineers, T. M. Salisbury and H. S. Gregory as representatives in Jackson, Miss. and New Orleans, La. They will serve Southern Mississippi, Eastern and Southern Louisiana, Mobile and Pensacola.

W. L. Clinton of Houston, Texas has been named as representative in the Southern Texas territory.

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CARBON LAMPS

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LAST LONGER

Especially Designed for Industrial Use

- Pilot Lights • Test Lamps
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Nalco Carbon Lamps are setting records of extra hours of service—wherever they're used—because they're engineered for rugged industrial performance. Actual tests in use prove their long-life superiority where inductive kick-back can feed into the lamp circuit. And where vibrations are constantly incurred, Nalco Carbon Lamps pay for themselves through longer, trouble-free service, fewer bulb replacements.

There's a NALCO Carbon Lamp for Your Every Need:

Standard types, shapes, sizes and colors are available, as well as special shapes, colors and construction features. Standard screw and special bases are supplied according to your needs.

Send for catalog sheets and price lists.

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NORTH AMERICAN
Electric Lamp Co.
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NEW!
Non-Inductive
Conductor Racks

Racks available for any number of cables—cable sizes 5/16" to 2⅛".

• Available in types for any number of cable, the M & W Types S-L Conductor Rack is designed so that cables are only partially surrounded by metal. This prevents induced current—permits the rack to be used for A.C. or D.C systems. Simple design makes for quick, easy mounting of cables.

Write today for Bulletin C-5-51 . . . contains full information on M & W Non-inductive Cable and Conductor Racks.

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MASONRY DRILLERS

- Get hole depth up 5 times as fast
- Use the drill that stays sharp up to 100 times longer
- Use Kennametal Masonry Drills

PLASTER, TILE, CEMENT, LIMESTONE, SLATE, BRICK, etc. are drilled at less cost, in less time, with less effort.

Get Results Like This:

"50 holes—1½ inches deep in tile, per grind. Speed—40 seconds per hole."

•

"Average 100 holes, 3½ inches deep in cement between regrind. Speed—15 seconds per hole."

•

"Saved 7½ hours in one day with one bit. Go on new job tomorrow. Saved money—had easier going."

Hard, diamond-like Kennametal Masonry Drills pierce smooth surfaces, drill true, sharp edged holes. Blade action ejects the cuttings, prevents binding, sticking. Bits are ¼" to 1½" in diameter and can be used in drill presses, hand braces, rotary drills. Write for bulletin EK now.

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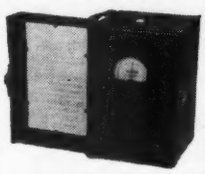
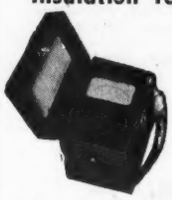
Measuring resistance to earth of protective grounds



VIBROGROUND in two models (4 and 3 ranges) is unaffected by stray AC or DC currents. Meets A.R.A.; A.I.E.E. specification. Self contained, portable, no leveling or cranking.

Insulation resistance testing



VIBROTEST — 36 models. Self contained, portable, no leveling or cranking. Push button operation, with safety features incorporated. Accurate from —40 to +140 degrees F.

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HYPOT discriminates between leakage breakdown and short. Voltage variable from 0 to 4000 AC. Fully grounded, portable, self contained. Reads actual secondary voltage applied. Red light warns when energized. Shielded leads.

WRITE FOR BULLETINS

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A. A. Berard Elected President of Ward Leonard

Dawson J. Burns of the Ward Leonard Electric Co., Mount Vernon, N. Y., who resigned the office of president of the company at a meeting of the Board of Directors held September 28, was elected chairman of the Executive Committee. Mr. Burns has been a member of the Board of Directors since 1903, serving the company as vice president from 1908 to 1944, at which time he was elected president.

Arthur A. Berard, executive vice president and general manager since 1944, was elected president and general manager. Mr. Berard, who joined the company in 1920, has been a member of the Board of Directors since 1927 and has served as factory manager and general sales manager.

Westinghouse Appointments

Marshall N. Waterman, a former member of the executive staff of the Electrical Testing Laboratories, Inc., New York City, has joined the Westinghouse Lamp Division, Bloomfield, N. J. as staff assistant to Ralph R. Brady, commercial engineering manager.

The appointments of Harry E. Seim as general manager of the Sturtevant Division at Hyde Park, Boston, Mass., and Tom Turner as general manager of the Elevator Division at Jersey City, N. J. have been announced by the Westinghouse Electric Corp.

•

Sola Electric Company, Chicago, Ill., has announced the appointment of H. U. Hjermstad as assistant to the president, Mr. Hjermstad comes to Sola from Federal Enterprises, Inc., where he held the position of vice president in charge of manufacturing and engineering for the past eleven years.

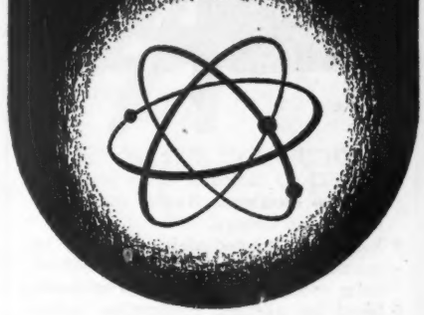
•

The C. M. Hall Lamp Company of Detroit, Michigan, has sold its Radiant Heat Division to the **Triangle Equipment Company** of Nutley, N. J. The nationwide sales organization of the Radiant Heat Division is being taken over by Triangle who contemplate no change in sales or service policies.

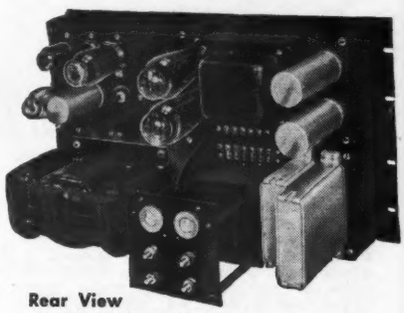
•

The Crocker-Wheeler Electric Manufacturing Company, Division of the Joshua Hendy Corporation, Ampere, N. J., has reopened its Buffalo branch office in the Ellicott Square Building. The new Buffalo branch, operating directly under the New York District manager, is headed by Louis E. Rau.

QUICK AS AN ELECTRONIC WINK



That's how fast a STABILINE Automatic Voltage Regulator corrects line voltage fluctuations. Type IE (Instantaneous Electronic) has no moving parts — is completely electronic in operation Designed to act instantaneously—with a waveform distortion not exceeding 3 percent — and to keep output voltages stable within ±0.1 of 1 percent of the preset value, regardless of line variations. For any load current change or load power factor change from lagging .5 to leading .9, the STABILINE Type IE will hold the output to within ±0.15 volts of nominal. Various models available in numerous ratings.



Rear View
STABILINE Type IE

Bulletin 547 gives you information on this and other Superior Electric voltage control equipment. Write for your copy today.

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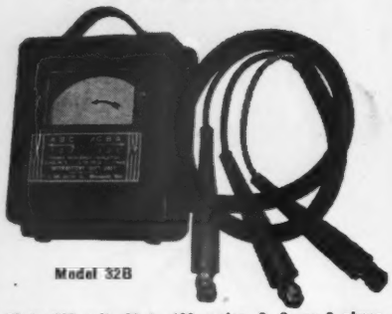
GET POSITIVE PHASE ROTATION READINGS *Faster* with the new "SELCO" INDICATOR



50 to 600 volt, 25 to 400 cycles, 2, 3, or 6 phase

- The SELCO Indicator gives you quick positive readings. Avoids costly mistakes, and delays.
- Indicates immediately phase sequency by numerical, alphabetical, color coding, and CW-CWW methods.
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with this amazing tool . . .

THE OUTLET DETECTOR

Here's a sturdy, $15.00 device with which you may instantly locate the exact position and outline of hidden metal outlet boxes, steel conduit and armored cable. Whether "lost" under plaster, wood, linoleum, thin tile or concrete, the DETECTOR finds them . . . saves costly wall demolition. DETECTOR emits a high frequency violet spark (when box is detected) from tip of removable steel "MARKER" electrode.

★ Residential, Commercial and Industrial Contractors all need several OUTLET DETECTORS.

★ Chief Electricians of Institutions and office buildings need a DETECTOR in making wiring changes.

★ PRICE IS ONLY $15.00, postage prepaid. Includes DETECTOR unit with 6-feet of rubber cord. Safety design employs 12" knurled bakelite case, with spark volume control knob. Operates on 110 A.C. only.

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Please send me.....OUTLET DETECTORS, at $15.00 each (postage prepaid).

☐ check or money order attached ☐ Send parcel-post collect ☐ Send for 10-day trial

Name .....
Address .....
City..... State.....

Curtis Lighting, Inc., Chicago, Ill., has announced the retirement of J. L. Stair, consulting engineer. Mr. Stair has long been an outstanding personality in the lighting field. He has been an active member of the Illuminating Engineering Society for many years serving in various capacities—President (1933-1934), chairman of the Chicago section, chairman of numerous committees. He was one of the first to be elevated to the grade of Fellow in the IES.

•

The Electric Products Company, Cleveland, Ohio, recently appointed Hubert Kaub and Company of Denver, Colo. as direct factory representatives covering the states of Colorado, Wyoming, Utah, New Mexico and El Paso County of Texas.

•

Illinois Electric Porcelain Company, Macomb, Ill. has completed its $125,000 expansion program. The new oil fired tunnel kiln cost $63,500 while the balance of the expenditure was used for a plant addition and other improvements in the existing factory.

•

Benbow Manufacturing Company, Redwood City, Calif. has announced the appointment of William C. Welde, 1610 North Street, Philadelphia, Pa. and Campbell & George Company, 379 Brannan Street, San Francisco, Calif., as sales agencies for Trac Troly.

•

The Great Western Fuse Company, Pittsburgh, Pa. has announced the appointment of Jos. L. Barnard Associates, Inc., Minneapolis, Minn. as sales representatives in Minneapolis, North Dakota and Western Wisconsin.

•

The appointment of William W. Bracken as field supervisor in **S & M Lamp Company's** Flood-Lite Division, Los Angeles, Calif., was announced recently.

•

B. F. Bilsland has been promoted from manager of the **Allis Chalmers** Chicago district to manager of the company's newly formed Midwest region.

•

Cannon Electric Development Company, Los Angeles, Calif., has named Henry Yates Satterlee to the company's factory sales engineering staff.

Solid ANCHOR SUPPORT 50 TO 10,000 LBS.

PAINE
SCREW EXPANSION
ANCHORS

EASILY INSTALLED
CONCRETE
STONE
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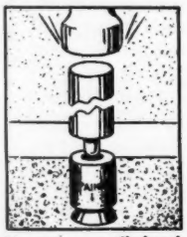
- RUST PROOF
- PRECISION THREADED
- SET FLUSH OR AT ANY DESIRED DEPTH
- MACHINE SCREW SIZES 6-32 through 5/8-11


Hammer until lead sets around cone

Screw anchored object as tight as possible

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from being muffled or "drowned out" by the surrounding noise the selection should be on the basis of a tone contrast. Such contrasting signals can be heard more clearly and will command positive attention. Signals having a high pitch should be used to overcome a deep toned noise. As an example, the sound of a bell will more readily be heard over the noise of operating generators in a power plant as compared to a horn. This is because the sound of the horn is more likely to blend with the constant hum of that certain pitch or frequency. Whereas, while the bell has a lower loudness rating it commands attention because it has a different tone. In contrast with this example is the problem of a plant where metal is handled. Such noises blend with the sound of bells so therefore horns are found to be the most satisfactory. In other places where noise levels are low, quiet is desirable, and attention is required without annoyance, it is suggested that a small mild tone bell, chime or buzzer be used. For frequent calls, use the clear, resonant signals. For the emergency alarms use the loud startling signals.

Distance Effect

The chart in Fig. 4 shows sound levels from the source of the signal to a distance of one hundred feet. The loudness ratings in Fig. 3 are taken at the source of the signal. Obviously, the intensity of the sound produced by the signal device deteriorates as the distance from the signal increases. This fact must be thoroughly considered in arranging the signals for even distribution of the sound. The chart shows some typical studies of the air horn or trumpet, a high powered electric horn or Kodaire, a six inch vibrating bell, a six inch single stroke bell and a large buzzer. As will be noted a six inch vibrating bell produces a sound of approximately 129 decibels or its equivalent or 1,300,000 loudness units at its source while the sound output is reduced to approximately 70 decibels or 7,950 loudness units at the furthest distance shown on the chart.

Signals should be evenly distributed throughout a given area. A typical example of this is shown in Fig. 5. In the upper section one signal is shown with the expectation that one large signal will cover the entire area. Under such conditions it will be found that the sound in zone "A" will be entirely too loud, zones "B-1" and "B-2" will

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PROTECTS	Fully, automatic thermal relay with unusually long life that eliminates blinking lights and protects all auxiliary equipment.
SIMPLIFIES	Replacement of worn-out lamp automatically restores closed circuit—replacement of starter unnecessary. No button to push.
REDUCES COSTS	Magno-Tronic starters provide exact timing in the lamp electrode—preheating process preventing excessive loss of emission material, thereby assuring the maximum in the useful life of a lamp. The established quality of this starter saves considerable time in maintenance and man hours required to repair and/or replace an inoperative lighting unit.
VERSATILE	Will operate efficiently over an extended voltage range under widely varying temperatures.

GUARANTEED FOR ONE YEAR.
The (SP-15-20) for use with either 15 or 20 watt lamps
The (SP-30-40) for use with either 30 or 40 watt lamps
The (SP-100) for use with 100 watt lamps

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MAIN PLANT Newark 2, N. J.

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SELECTION OF AUDIBLE SIGNALS [FROM PAGE 61]

the signal units. It should be noted that the signal units must produce a louder and a more distinctive sound than the prevailing noises. Noise which the audible signals must overcome will as a rule vary from one location to another in the same building and sometimes in the same section of a floor depending upon the type of operations.

Noise Levels

A table with a range of noise levels is shown in Fig. 2. The first column shows readings in decibels. The second column shows equivalent readings in loudness units of the American Standards Association. The third column lists applicable locations. No simple proportional relationship exists between the decibel readings, however, for rough estimating purposes it may be assumed that an increase of approximately eight decibels is the equivalent to doubling the intensity of the noise. For instance an increase in the rating of 100 decibels to 108 means approximately a one hundred percent increase and not an eight percent increase. Whereas, the loudness units have a directly proportional comparison of the loudness inasmuch as an intensity of 200,000 loudness units is one hundred percent louder than a noise of 100,000 loudness units. It is to be noted that the figures in the second column are to be multipled by 1000, thus, the first figures shown on line one would become 215,000 to 875,000 loudness units. Good results may be obtained by the use of this table in lieu of the sound-level meter.

A table showing the audible signal characteristics is shown in Fig. 3. The first column shows readings in decibels. The second column shows equivalent values in loudness units. The third column shows the type of signals usually classified as the industrial group. The fourth column shows the characteristics and tone qualities of the audible signals. This basic table as well as the following chart in Fig. 4 are the result of research and tests made in the laboratories of the Faraday Electric Corporation.

It is important to select signal devices with the correct characteristics and tone to overcome the type of noise in each particular location. This means that to prevent the sound of the signal

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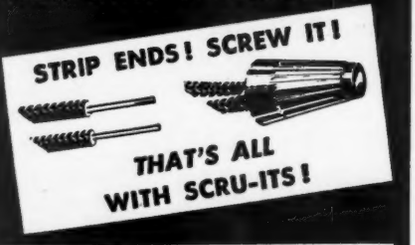

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A GOOD Habit

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be favored with about the proper intensity of sound, while zones "C-1" and "C-2" will have a weak sound and therefore will be ineffective. On the other hand in the lower section two signals somewhat smaller are used, however, they are evenly distributed insofar as the length and the width of the area is concerned. Under such conditions the sound is evenly distributed, practically everyone hears the signal clearly at the correct loudness and tone, annoyance is eliminated and efficient results are obtained. The number of signals required is determined by the size of the area under study and the number of concentrated peak noise levels therein.

Sound Distribution

Summing up the various suggestions relative to the selection and locating signal units to produce the best results we refer again to Fig. 5. Assuming the locality to be a light assembly room approximately 100 feet long and 50 feet wide, and the noise level approximately 80 decibels or 17,100, loudness units fairly evenly distributed. If one ten inch vibrating bell is installed in the center of this space, with a loudness rating of 134 decibels or 2,300,000 loudness units, it would be entirely too loud in the A zone. At a distance of 50 feet the sound of the signal would be reduced to approximately 83 decibels or 21,400 loudness units. This would be increased somewhat due to the deflection from the ceilings and walls, and again would result in a higher sound than necessary. On the other hand, if two, four-inch bells were to be used each having a sound output of 125 decibels, or 900,000 loudness units the sound would be reduced at a distance of 25 feet to approximately 76 decibels or 12,000 loudness units which would be increased by deflection to approximately 81 decibels or 19,000 loudness units, which would be ample to be heard throughout the area.

Outdoor signaling systems usually require much more power than indoor signaling systems even though the surrounding noise level may be no higher. This difference is because of the absence of walls, floors and ceilings which ordinarily would deflect the sound, and because of the dampening effect of nearby trees and obstacles such as buildings, large open fields, hills and the direction of winds present a great problem. Again the advantage is gained by several smaller audible signal units instead of depending upon one large one.

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Of Electrical Construction and Maintenance, published monthly at Albany, N. Y., for October 1, 1948.

State of New York } ss.
County of New York }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared J. A. Gerardi, who, having been duly sworn according to law, deposes and says that he is the Secretary of the McGraw-Hill Publishing Company, Inc., publisher of Electrical Construction and Maintenance, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Acts of March 3, 1933, and July 2, 1946, (section 537, Postal Laws and Regulations), printed on the reverse of Form 3526, to wit:

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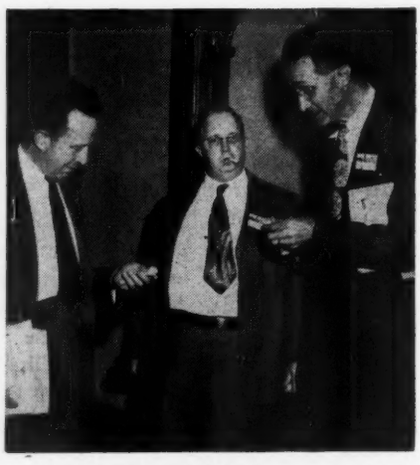
COST FACTORS FOR CABLES

[FROM PAGE 59]

fact, at high rates of capitalization for power losses it may be in some instances less costly to install a much larger size cable than actually required for the particular current being carried. For example, with losses capitalized at a high rate the total dollars per ampere for supplying a 70-ampere load may be less for a No. 2 AWG cable than for a No. 4 AWG cable, even though the latter has a lower installed cost.

However, with the rate of capitalization of losses ($80 per kw.) used in Figs. 4 to 9 it will be observed that in all cases the smallest cable permitted by the actual current rating was at least as low as, and usually lower in cost in dollars per ampere than the next larger size cable. In some cases, however, the difference was quite small. For example, let us consider the choice of size of a Type RH cable for supplying a 125-ampere load. The costs of carrying this current per 100 ft. are obtained from Fig. 6b and summarized in Table 7.

It is less costly for the 125-ampere load to use the No. 0 AWG cable. However, it is only slightly more costly to use the larger size 3/0 cable, although it is appreciably more costly for a 4/0 cable. Thus if a cable were to be selected for the 125-ampere load that could also be adopted as a standard size, the 3/0 cable would probably be selected and could be used for any load up to a rating of 176 amperes. With such a small difference in cost at the lower current ratings there would ap-



G. M. Strecker (left) dist. supt., Public Service Co. of Colorado, Boulder, and G. R. Hubbard, director of Public Service, City of Boulder, examine new self-threading thin-wall fittings developed by T. M. Briegel (center) of Briegel Method Tool Co., Galva, Ill.

pear to be little justification in stocking or using either No. 0 or 2/0 cable. Hence, in this particular case the Number 3/0 could be selected as standard and used for all applications requiring a current rating anywhere between 115 amperes (the rating of No. 1 is 114 amps) and 176 amperes.

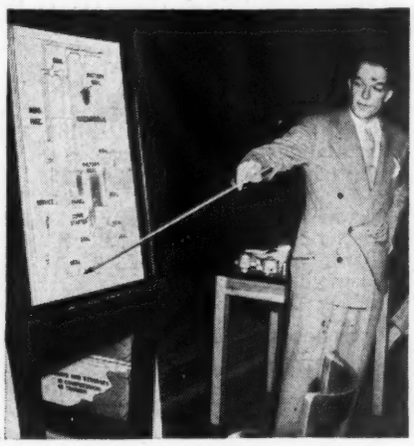
While this particular example is somewhat more striking than many of the remaining ones, it may be seen from the cost charts that there are similar small differences in cost between successive cable sizes in a number of instances. This influence and the desire to standardize cable sizes which have successively 25-50 percent greater current than the next smaller standard size make possible the selection of a list of suggested standard sizes shown by Table 8.

It is believed by adopting these standards that though the minimum installed cost may not be achieved for every installation, on the whole, for an over-all job, the economies previously summarized for standardization will result in the minimum cost to plant operations.

Cable sizes have not been extended to small sizes since, in general, the available short circuit current will not permit application of small size cables for power feeders.

Larger sizes are not shown since, in general, they are more expensive and less versatile in their application than the smaller sizes. For the occasional high current encountered it will usually be a better choice to use two or more of the smaller cables in parallel.

A summary of the data already presented is given in Table 9 for convenience in making estimates and comparisons.



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